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IDENTIFIERS	Air Force; *Environmental Medicine; Military Curriculum Materials

ABSTRACT

This five-volume student text is designed for use by Air Force personnel enrolled in a self-study extension course for environmental medical specialists. Covered in the individual volumes are (1) control of communicable diseases (principles of epidemiology and biology; food, waterborne, airborne, and sexually transmitted diseases; medical zoology; and field sanitation); (2) occupational medicine (humans, medicine, and work; standardized occupational health programs; respiratory protection programs; and hearing conservation); (3) facility sanitation and environmental surveys (medical aspects of surveys and evaluations in special environments); (4) food inspection and technology (food technology for animal and nonanimal origin subsistence, procurement of subsistence, and food inspection); and (5) medical readiness (medical readiness; natural disasters; and nuclear, biological, and chemical warfare). Each volume in the set contains a series of lessons, exercises at the end of each lesson, a bibliography, and answers to the exercises. Volume review exercises and a change supplement for the package are also included. (MN)

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ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

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Extension Course Institute
Air University

CE 044 809

ECI COURSE MATERIALS SHIPPING LIST

COURSE NUMBER	COURSE TITLE	EFFECTIVE DATE
90850	ENVIRONMENTAL MEDICINE SPECIALIST (AFSC 90850)	8 Jan 86

INSTRUCTIONS: The following materials are needed to complete this course. Check this list immediately upon receiving your course package, and if any materials are missing or incorrect (numbers don't match), notify ECI immediately. (Use the ECI Form 17 for this purpose, and be sure to include your identification number, address, course and volume number, and VRE form designation if a VRE is involved.) Send all correspondence separately from your answer sheet.[1]

ITEM	TYPE	DESIGNATION OR TITLE	INVENTORY CONTROL NUMBER	VRE ANSWER SHEET IDENTIFICATION
3	VOL	VOL 1, Control of Communicable Disease	90850 01 8502	
4	VRE	VOLUME REVIEW EXERCISE (VOL 1)	90850 01 23	90850 01 23
5	VOL	VOL 2, Occupational Medicine	90850 02 8503	
6	VRE	VOLUME REVIEW EXERCISE (VOL 2)	90850 02 25	90850 02 25
7	VOL	VOL 3, Facility Sanitation and Environmental Surveys	90850 03 8501	
8	VRE	VOLUME REVIEW EXERCISE (VOL 3)	90850 03 25	90850 03 25
9	VOL	VOL 4, Food Inspection and Technology	90850 04 8501	
10	VRE	VOLUME REVIEW EXERCISE (VOL 4)	90850 04 25	90850 04 25
11	VOL	VOL 5, Medical Readiness	90850 05 8502	
12	VRE	VOLUME REVIEW EXERCISE (VOL 5)	90850 05 23	90850 05 23
13	SUPP	CHANGE SUPPLEMENT (Vols 1-5)	90850 00 S01 8505	

NOTES: DIRECT ANY QUESTIONS OR COMMENTS RELATING TO ACCURACY OR CURRENCY OF TEXTUAL MATERIALS TO AUTOVON 240-2058.

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[1] *SEE REVERSE SIDE FOR ADDITIONAL INSTRUCTIONS.*

ECI FORM JUN 84 25 PREVIOUS EDITION WILL BE USED.

LIST OF CHANGES

COURSE NUMBER
90850

EFFECTIVE DATE OF SHIPPING LIST
8 Jan 86

CAREER FIELDS, POLICIES, PROCEDURES AND EQUIPMENT CHANGE. ALSO, ERRORS OCCASIONALLY GET INTO PRINT. THE FOLLOWING ITEMS UPDATE AND CORRECT YOUR COURSE MATERIALS. PLEASE MAKE THE INDICATED CHANGES.

NOTE: PLEASE MAKE THE CORRECTIONS INDICATED BELOW. THESE CORRECTIONS MAY OMIT SOME ERRORS, SUCH AS TYPOS, THAT DO NOT AFFECT THE MEANING OF THE MATERIAL.

1. CHANGES FOR THE VOLUME REVIEW EXERCISE: VOLUME 3

   a. Page 9, question 60, choice c: Change "when" to "was."

   b. Page 12, question 79: In the stem of the question, after "prepared," add "and."

2. CHANGES FOR THE VOLUME REVIEW EXERCISE: VOLUME 4

   a. Page 6, question 38, choice a: Change first "contract" to "contact."

   b. Page 8, question 55, choice d: Change "0098" to "008."

   c. Page 9, question, 69, choice c: After "*Supplies*" add "*Purchase Descriptions*."

   d. Page 15, question 121: In the stem of the question, change "tab" to "lab."

3. CHANGES FOR THE VOLUME REVIEW EXERCISE: VOLUME 5

   a. Page 6, question 40, choice c: Change "Chocking" to "Choking."

   b. Page 7, question 47: In the stem of the question, change "gargles" to "gargling."

90850 00 S01 8505

CHANGE SUPPLEMENT

CDC 90850

ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

Volumes 1, 2, 3, 4 and 5

__IMPORTANT__: Make the corrections indicated in this supplement before beginning study of Volumes 1, 2, 3, 4 and 5. This supplement contains "pen-and-ink" changes and replacement pages. It is perforated and three-hole-punched so that you can tear out the replacement pages and insert them in your volumes. You are not required to post any changes listed in this supplement which correct typographical errors, unless such errors change or otherwise affect the meaning of the material.

EXTENSION COURSE INSTITUTE

Air University

CHANGES FOR THE TEXT: VOLUME 1

Pen-and-Ink Changes

Page-Col	Subject	Line(s)	Correction
iii	Preface	18	Change "relates" to "relate."
1L		10 fr bot	Change "or" to "of."
3L		Last	Change "applied" to "applies."
3R		30	Change "TExas" to "Texas."
4L		1	Change "ENS" to "EHS."
		Last	Change "AFter" to "After."
5L	(001)-8	3	Change "hwo" to "who."
5R		21	Change "diary" to "dairy."
		12 fr bot	Change "many" to "man."
6L		17 fr bot	Change "Defence" to "Defense."
6R		3	Change "th" to "the."
7L		5	Change "reserve" to "resource."
13R		6 fr bot	Change "phrases" to "phases."
		16 fr bot	Change "deadend" to "dead end."
15R		3	Change "system" to "systems."
16L		8	Change "copulatoryorgan" to "copulatory organ."
16R		25	Delete duplicate "and."
17R		17	Delete duplicate "first."
22L		1	Change "eustacian" to "Eustachian."
		13 fr bot	Change "glove" to "globe."
22R		9	Change "contration" to "contraction."
24L		1	Change "eustachian" to "Eustachian."
25L		11	Change "prespiration" to "perspiration."
25R		7	Change "or" to "of."

Page-Col	Subject	Line(s)	Correction
25R		4 fr bot	Change "wastes" to "waste."
27R	(014)-1b		Change "Mitrochondria" to "Mitochondria."
		21 fr bot	Change "chromatic" to "chromatin."
28L	(015)-1		Change "!" to "1."
30L		13 fr bot	"018. Cite . . . cultivating bacteria" should be in bold face print.
		10 fr bot	"The Gram Stain" should be in bold face print.
30R		9	Change "no" to "not."
31R		21	Change "use" to "us."
		27 and 29	Change "form" to "from."
32L		17	Change "*nigicans*" to "*nigricans*."
		18	Change "mole" to "mold."
		20	Change "subtrate" to "substrate."
		21	Change "sporgagia" to "sporangia."
32R		3	Change "010" to "020."
37R		7	Change "propely" to "properly."
38L	(023)-3		Change "fom" to "from."
38R		1	"3-3. Distribution of Disease" should be in bold face print.
		22 fr bot	Change "gastrointe" to "gastrointestinal tract. Some."
39R		7	Change "women" to "woman."
40R		25	Change "vacines" to "vaccines."
		28	Change "chile" to "child."
41R		13 fr bot	Change "or" to "of."
42R		last	Change "*aeypti*" to "*aegypti*."
43L		4 fr bot	Change "105-D" to "105D."
43R		19	Change "is" to "are."

Page-Col	Subject	Line(s)	Correction
44L		7	Change "mumber" to "number."
	Problem 2	13	Change "# 2" to "#2."
50R		Last	Change "anywhere" to "Anywhere."
51L		15 fr bot	Change "nowhere" to "Nowhere."
53L		12 fr bot	Change "you" to "your" and after "course" add ")."
53R		37	Change "probably" to "probable."
54R	(033)-2	2	Change "in" to "is."
		18	Change "City" to "Cite."
55R		2	Change "asure" to "assure."
57L		10	Change "Occupation" to "Occupational."
		23	Change "Investigation" to "Investigating."
61L		17	Delete duplicate "the."
61R			Add "CHAPTER 4" in top right corner.
62R		14 fr bot	Change "isionous" to "isonous."
63L		2 fr bot	Change "fermental" to "fermented."
63R		4 fr bot	Change "is" to "in."
66L		21	Change "cure" to "sure."
70R		10	Change "axact" to "exact."
72R		20	Change "city" to "cite."
73L		37	Change "*giardia*" to "*Giardia*."
76L		2	Change "or" to "of."
76R			Add "CHAPTER 5" in top right corner.
		24	After "contact" add "with infected individuals."
		26	Delete "With infected individuals."
78L		22 fr bot	Change "muclei" to "nuclei."
79R		11	Change "TBAs" to "TB. As."

Page-Col	Subject	Line(s)	Correction
79R		22	Change "Tyberculosis" to "Tuberculosis."
80L		17	Change "chemiclly" to "chemically."
80R		7 fr bot	After "receive" add "a."
		16 fr bot	Change "fro" to "for."
81L	(048)-2		Change "bacteriologicl" to "bacteriological."
81R		30	Change "*Myacobacterium*" to "*Mycobacterium*."
84L		10 fr bot	Change "an" to "and."
84R			Add "CHAPTER 6" in top right corner.
87R		25	Change "cured" to "cures."
88L		11	Change "speticemia" to "septicemia."
		2 fr bot	Delete duplicate "approximately."
		17 fr bot	Change "malia" to "mia."
88R		26	Delete "often" and change "(i.e.," to "in."
		27	Change "male/female)" to "males/females."
		33	After "females" add "except during pregnancy."
89L		2	Change "developing" to "acquiring."
		7	Change "fro" to "for."
		5 fr bot	Delete "the."
89R		41	Change "teh" to "the."
90L		27	After "treat" add a period.
		34	After "This" add "is."
90R		6 fr bot	Change "antibiotices" to "antibiotics."
91L		4	Change "patient" to "patients."
91R		5 fr bot	Change "*trachomatic*" to "*trachomatis*."
92R	(055)-5	1	Change "resemble" to "resembles."
93L		10	Delete "large-virus,."

Page-Col	Subject	Line(s)	Correction
93R		25 fr bot	After "can" add "be."
97R		11 fr bot	Change "SErvices" to "Services."
		9 fr bot	After "(individual" add a comma.
99R	(060)-4		Change "9.3936" to "9.2936."
100R		20 fr bot	Change "State" to "States."
109R		27	Change "*Aegypti*" to "*aegypti*."
		6 fr bot	Change "general" to "genera."
113R		8-9	Delete "by the epidemiology . . . DOD agencies."
114L		3 fr bot	Change "Entomoloyg" to "Entomology."
119L		9 fr bot	Delete duplicate "reducing."
119R		15 fr bot	Change "fro" to "for."
121R		23	Change "if" to "is."
122L		1	Change "organism" to "organisms."
123L		9	Change "disease" to "diseases."
125L		10 fr bot	Change "fro" to "for."
126L		16 fr bot	Change "encephalities" to "encephalitis."
126R		3	Change "needs" to "heads."
		7 fr bot	Change "change" to "chance."
127L		18	Change "edges" to "edged."
131L		17 fr bot	After "together" add "to produce."
		18 fr bot	Change "engineers" to "Engineers."
136R		1	Change "076f" to "076."
		15	Change "fro" to "for."
137L		4	Change "1 1/2" to "2 1/2."
137R		5	Change "solder" to "soldier."
139L		12	Change "ine" to "in."
140R		9 fr bot	Change "percolution" to "percolation."

Page-Col	Subject	Line(s)	Correction
150L		6 fr bot	Change "*Aif*" to "*Aid*."
153L		12 fr bot	Delete "9."
157L		14	Change "I.R." to "O.R."
		15	Change "I.S." to "O.S."
158	Appendix	6	Change "(3)" to "(30)."
159L	006-1.(a)	2	Change "seed" to "speed."
159R	009-4	1	Change "helogenated" to "halogenated."
160R	012-4		Change "Epidermmis" to "Epidermis."
	012-7		Change "i.E." to "i.e."
161L	023-3		Change "formites" to "fomites."
162L	032-5		Change "031-1" to "033-1."
	036-2		Change "staaphylococcus" to "staphylococci."
162R	041-1		Change "341" to "431."
	043-2(3)		Change "163-12" to "161-24."
165L	070-1	1	Change "endemis" to "endemic."
		3	Change "chionosis" to "chinosis."
	070-6		Delete "(."
	073-5		Change "inutes" to "minutes."

Page Change:

Remove Pages	Insert Pages
163-164	163-164

(4) AFR 146-7.
(5) Textbooks, such as Longree's *Quantity Food Sanitation*.

044 - 1. False. Gearing training to a particular type of activity, either facility or especially work activity, is best.
044 - 2. False. The abbreviated course is given on initial employment. Annually, foodhandlers should receive a comprehensive course emphasizing personal hygiene and many other subjects.
044 - 3. True.

045 - 1. (1) c.
(2) a.
(3) e.
(4) b.
(5) f.
(6) d.
(7) f.
045 - 2. a. Control source of infection by proper sewage disposal and water purification.
b. Education of the public on how these conditions/diseases are transmitted; the need for good personal hygiene (i.e., importance of handwashing).
c. Isolation and treatment of infected individuals (in some cases).
d. Surveillance (by biostatistics) of waterborne diseases in the area.
045 - 3. Amebiasis (or amebic dysentery); giardiasis.
045 - 4. Schistosomiasis.
045 - 5. (a) MOT - Fecal-oral; Group affected - children in child care centers (poor personal hygiene) and military personnel because of crowding and lack of immunity.
(b) MOT - Personnel exposed to the body fluids (blood, saliva, semen, etc.) of an infected individual; Group affected - intervenous drug users, male homosexuals, people working in hemodialysis units, lab workers, operating room personnel, and dentists.
(c) MOT - Transmitted mainly by blood transfusions; Group affected - anyone requiring blood transfusions.

CHAPTER 5

046 - 1. Bacterial meningitis. Although not addressed in your career development course strep, enteroviruses, and influenza may also have a carrier state.
046 - 2. Changes H or N surface antigens.
046 - 3. When minor changes in the virus occur.
046 - 4. An antigenic shift.
046 - 5. An Air Force program designed for monitoring the incidence of influenza in the Air Force and detecting antigenic shifts or drifts.
046 - 6. By education of the susceptible population on how this disease is spread, prevented, and controlled; and by elimination of the source of infection through early diagnosis and treatment.

047 - 1. Chronic, subacute disease that most often affects the respiratory tract but may involve other parts of the body, too.
047 - 2. *Mycobacterium tuberculosis.*
047 - 3. Atypical mycobacteria resemble *Mycobacterium tuberculosis* and can cause tuberculosis like pulmonary infections; however, the treatment regimen and public health concerns differ from those for active TB.
047 - 4. Respiratory, by droplet nuclei.
047 - 5. The bacilli begin to multiply very slowly; some stay at the initial site of infection and others enter nearby lymph nodes and the blood stream. Within a few days the organisms go throughout the body and the white blood cells try to kill or surround them. Some of the TB bacilli die; others remain dormant for many years.
047 - 6. Symtoms may include fatigue, nervous irritability, weight loss, fever, chilliness, night sweats, loss of appetite, or a "cold" that hangs on. Uncommon symptoms that may also occur are coughing, spitting up of blood or blood stained sputum, chest pains, and shortness of breath.
047 - 7. History of symptoms, physical signs; microscopic examination of the patient's sputum; a chest xray.

048 - 1. Chemoprophylactic treatment (usually INH).
048 - 2. If the chest xray and interview are consistent with active TB.
048 - 3. (1) Household contacts of people with active TB.
(2) Recent convertors.
(3) People with previously known TB (now inactive) who had received inadequate chemotherapy.
(4) Positive reactors with abnormal chest xray; positive rectors under 35 years old.
048 - 4. Monitored closely with interviews for signs and symptoms, and liver function tests. If consistent elevations occur, have the patient evaluated by the physician.

049 - 1. One copy is held in suspense in the EHS section, and the original is placed in the patient's medical record.
049 - 2. If positive with the IPPD then the individual should be treated as any other positive reactor.
049 - 3. The annual report is submitted to major command annually in the month of January.

050 - 1. Biostatistics; disease reporting screening and testing; and searching for contacts.
050 - 2. Humans are reservoirs for infection; mobility of population; existence of carriers; rapidly changing viruses; limited effective immunizations/vaccinations.
050 - 3. Avoiding overcrowding; health education; surveillance; isolation and treatment of infectives; immunizations and vaccinations of susceptibles; chemoprophylactic treatment when appropriate.

CHAPTER 6

051 - 1. Mucous membrane.
051 - 2. Meatus, penis, or scrotum.
051 - 3. Cervix.
051 - 4. Fever, malaise, loss of appetite, dermititis.
051 - 5. 8 to 10 weeks.
051 - 6. She may become sterile.

052 - 1. False; smears are sufficient for identifying the presence of gonorrhea in symptomatic males but cultures are necessary to confirm diagnosis in asymptomatic males.
052 - 2. True
052 - 3. False; if treated with any regimen other than 4.8 million units of agueous procaine penicillin G, then they need to have the monthly serologies (for 4 months) to detect syphilis.

053 - 1. (1) b.
(2) d.
(3) a.
(4) e.
(5) c.

054 - 1. Darkfield.
054 - 2. VDRL.
054 - 3. Lumbar puncture.
054 - 4. Primary.
054 - 5. FTA-ABS.
054 - 6. Serologies.

055 - 1. False. Herpes simplex virus 2 invades the nerve cells of the infected area and travels to the lower part of the spinal cord where it lies dormant until the body is weakened and the virus become reactivated.
055 - 2. True.
055 - 3. False. It is transmitted to the child during delivery.
055 - 4. True.
055 - 5. False. In men untreated infections can cause infections of

the prostrate and epididymis. PID may develop in women.
055 – 6. False. Test of cure cultures should be done 3 to 6 weeks after treatment.

056 – 1. A throat infection caused by the fungus that causes vaginal yeast infections. This condition is transmitted through oral-genital contact.
056 – 2. Elephantiasis, rectal stricture and constipation.
056 – 3. Douching, antibiotics, and pregnancy.

057 – 1. Ureplasma; and *Chlamydia trachomatis.*
057 – 2. Hepatitis B.
057 – 3. AIDS.
057 – 4. Urethra.
057 – 5. Women.
057 – 6. Crab.
057 – 7. NGU.

058 – 1. Tested, treated.
058 – 2. Examinations or tests.
058 – 3. Social group.
058 – 4. That they may have become infected.
058 – 5. The name and number of sexual partners.

059 – 1. After diagnostic examination and prior to treatment.
059 – 2. Critical period.
059 – 3. An image of competence and understanding.
059 – 4. Mode of transmission, symptoms, and complications of the patient's disease.
059 – 5. Surprise and disgust.

060 – 1. True; except under legal court order.
060 – 2. True.
060 – 3. True.
060 – 4. False. Also includes civilian contacts residing in territories or possessions of the U.S.; (e.g., Virgin Islands and Puerto Rico).
060 – 5. False. EHS provides Patient Affairs with the statistical data on STD cases.

CHAPTER 7

061 – 1. (1) b.
(2) a.
(3) b.
(4) d.
(5) c.
(6) c.

062 – 1. In insects the "skin" on the outside becomes hardened into an outer skeleton and is called an exoskeleton.
062 – 2. Head, thorax, and abdomen.
062 – 3. It helps us understand how many vectorborne diseases are transmitted.
062 – 4. Changes in form or structure during an insect's development.
062 – 5. Mosquitos, fleas, and flies.
062 – 6. Plant and Animal.
062 – 7. Phyla.
062 – 8. Pictorial and written.

063 – 1. Physical control.
063 – 2. Biological.
063 – 3. Chemical.
063 – 4. Draining swamps or any standing water; filling in a marshy area or deepening ponds.
063 – 5. Some bacteria, top feeding minnows and genetic controls such as radiation and chemosterilants.

064 – 1. Classified by the way they are used, mode of action, or chemical composition.
064 – 2. Chemical composition; because you can determine the hazard posed by the pesticides by the effects of the chemicals they are made of.
064 – 3. Anticoagulant; causes capillary damage and may interfere (in sufficient concentration) with the formation of prothrombin (causes blood to clot), therefore resulting in massive internal bleeding.
064 – 4. Organophosphates (phosphorus compounds).
064 – 5. Hydrogen cyanide (HCN) and methyl bromide.
064 – 6. Resistance.
064 – 7. Epidemiology Division, USAFSAM, Brooks AFB, TX.

065 – 1. True.
065 – 2. False. Only the female mosquito bites. Most subfamilies require a blood meal before eggs are produced. Species of the subfamily Toxorhynchitinae do not blood feed but subsist entirely on plant juices.
065 – 3. False; all mosquito larvae come to the surface for air except those in the genera *Coquillettidia* and *Mansonia*, which obtain air by piercing aquatic plants.
065 – 4. True.
065 – 5. True.
065 – 6. (1) a.
(2) b.
(3) c.
(4) a,b,c,d,e.
(5) d.
(6) c.
(7) d.

066 – 1. Light-baited New Jersey traps.
066 – 2. Some important vector species are not phototactic.
066 – 3. Attract more mosquito species, increase yield, eliminates trash insects, and male mosquitos.
066 – 4. To determine where mosquito breeding sites are located.
066 – 5. *Aedes aegypti.*

067 – 1. Useful tool for organizing trap data and comparing different time periods or locations.
067 – 2. One trap operated for 1 night.
067 – 3. The total number of females trapped divided by the total trap nights.
067 – 4. To show a population fluctuation in a specific species or particular group of mosquitos. Both TI and STI are valuable in planning mosquito control.
067 – 5. TI equals 7.4.

068 – 1. Through chemical action of poisoning or through physical and chemical action to keep larvae from breathing.
068 – 2. By applying residual pesticides on surfaces where they rest or by space spraying.
068 – 3. Dragonfly larvae; *Gambusia affinis* minnows; Fundulus species of minnows (salt water); *Telapia mossambica* (tropical fresh water fish); certain mosquito larvae subfamilies - Toxochynchites and Psorophora and the BTI bacteria.
068 – 4. Anopheles spp.
068 – 5. The use of two or more types of control methods to solve a pest problem.

069 – 1. (1) c.
(2) b.
(3) b.
(4) d.
(5) c.
(6) a.
(7) e.
(8) e.
069 – 2. By applying pesticides to the animal hosts and to the infested areas.
069 – 3. Personal cleanliness.
069 – 4. Proper sanitation; screening houses; and using insecticides to kill the adults and larvae.
069 – 5. By personal contact and using and wearing infested clothes, bedding, towels, etc.
069 – 6. DEET (di-Ethyl Toluamide).

CHANGES FOR THE TEXT: VOLUME 2

Pen-and-Ink Changes

Page-Col	Subject	Line(s)	Correction
1R		4 fr bot	After "exposed" add a semicolon.
		19 fr bot	Change "of" to "from."
3L		36	Change "change" to "changes."
3R		3	Delete ")."
		5	After "*Sanitation*" add ")."
		25	After "be" delete "as."
5L		8	The word "captured" did not print plainly.
		26 fr bot	Change "mucus" to "mucous membrane."
8L		1	Change "air force" to "Air Force."
		2	Change "tolene" to "toluene."
13R		8 fr bot	After "inflammations", change ";" to "."
		9 fr bot	After "plants" and "ulcers" change semicolons to commas and after "acne" change period to comma.
17L		44	Change "health" to "Health."
		50	Delete "if it is an injury" and after "to" add "the."
		51	Before "monthly" insert "the."
21L		15	Change "toxoplasma gondii" to "*Toxoplasma gondii*" and "plasmodia" to "Plasmodia."
26L		16 fr bot	Delete "during pregnancy."
		17 fr bot	After "mrem," add "during pregnancy."
26R		23	Change "value if" to "value. If" and after "controlled" change semicolon to comma.
28L		3	After "through" change "your" to "the."
31R		30-31	Change "Health Surveillance" to "health surveillance."

Page-Col	Subject	Line(s)	Correction
32L		23	Change "time-weighed" to "time-weighted."
33L		6 fr bot	Change "6 months" to "1 year."
		7-8 fr bot	Delete "the BEE annually . . . workplace. Additionally,."
		9 fr bot	Change "annual" to "periodic."
33R		36	Change "Survey" to "Sample."
		12 fr bot	After "respirators" add "or hearing protectors."
35L		29	Change "workers" to "worker's."
35R		20	Change "number" to "Account Number."
		20-21	Change "workplace identifier" to "Workplace Identifier."
		10 fr bot	Change "annual," to "periodic" and after "surveys" add a comma.
		Last	Delete "other."
39L		1	Change "evaluation forms" to "evaluations."
		15 fr bot	Change "Medicine" to "Health."
39R	(210)-5		Delete.
		5 fr bot	Change "*base line*" to "*baseline*" in both places.
43	Fig. 2-8	1	Change "OCCUPATIONAL" to "ORGANIZATIONAL."
		Legend	Change "Functional account . . . (OSC) codes" to "Organizational Structure Codes (OSC)."
43R		5	Change "consolidated base personnel office" to "Consolidated Base Personnel Office" and change "central" to "Central."
		6	Change "civilian personnel office" to "Civilian Personnel Office."
		8	Change "results" to "areas."
		13	Change "specialty codes" to "Specialty Codes."
44L		13	Delete "(fig. 2-8)."

Page-Col	Subject	Line(s)	Correction
44L		16	Change "the list only on the" to "on the list, only those."
		31	Change "personnel" to "Personnel" and "management" to "Management."
44R		9 fr bot	After "the" add "Newcomer's."
		18 fr bot	Change "*Base line*" to "*Baseline*."
		19 and 29 fr bot	Change "base line" to "baseline."
46L		6-7	Delete "the physical examination and standards section" and change "(PES) personnel who" to "PES personnel to."
46R		1-2 fr bot	Change "workers, paying close . . . results, and" to "worker; for example, close scrutiny of histories for commonality of symptoms, comparison of screening results, and review of the SF 600 to verify."
49L		9	Change "information codes and" to "codes,."
50L		2	Delete "has" and after "10" add "leading."
52L		1	Change "knowledgable" to "knowledgeable"
		2	Change "Workers" to "However, workers."
55L		13-14	Change "organic vapors, . . . mist and fume" to "vapors and gases and any combination of particulate-vapor/gas contaminants."
56R		2	Delete "either a hose mask or."
		10 & 16	Change "air-supplied" to "airline."
59R		4 fr bot	Change "eustachian" to "Eustachian."
64L		7	Change "depends" to "depend."
64R		8 fr bot	After "alcohol" add "solution."
65L		6	Change "circut" to "circuit."
		21 fr bot	Change "might be" to "one."
65R		18 fr bot	After "for" add "the" and change "test" to "tests."

Page-Col	Subject	Line(s)	Correction
73R		19-20	Change "bioenvironmental engineering section" to "Bioenvironmental Engineering Section."
74R		25	Change "that" to "a."
75R		19 fr bot	Change "V" to "V-51R."
		24 fr bot	Change "flents" to "Flents."
79R		10	Change "quarterly" to "occupational."
91R	203-7		Delete "If it is an injury then" and change "a" to "A."
92L	210-5		Delete.

CHANGES FOR THE TEXT: VOLUME 3

Pen-and-Ink Changes

Page-Col	Subject	Line(s)	Correction
2R		2	Change "samitation" to "sanitation."
8R		1	Change "2" to "1."
11R		2 fr bot	Delete second "a."
		15 fr bot	Change "shoudl" to "should."
13R		12	Change "2" to "1."
14L		16 fr bot	Change "2" to "1."
14R		18	Change "below" to "above."
17L		5 fr bot	Change "of" to "or."
		6 fr bot	Change "C" to "c."
24R		20	After "your" delete ",."
34L		21	Change "In-flight" to "and Inflight."
35R		16	Change "suplementary" to "supplementary."
38R		2	Delete "aspect."
39R		6	Change "SErvice" to "Service."
		23	Change "aircrewmembers" to "aircrew members."
		3 fr bot	Change "imunities" to "immunities."
43L		23	Change "ech" to "each."
46L	401-6		Change "of" to "or."

CHANGES FOR THE TEXT: VOLUME 4

Pen-and-Ink Changes

Page-Col	Subject	Line(s)	Correction
1L		21 fr bot	Change "from" to "form."
2L		13 fr bot	Change "Posterior" to "Caudal" and delete "or caudal region."
		14 fr bot	Change "Anterior" to "Cranial" and delete "or cranial region."
2R		16 fr bot	Change "organis" to "organ is."
3R		11-12 fr bot	Change "The *phalanges* (digits) have six" to "Each digit has three" and after "and" change "six" to "three."
6R		23	Change "function" to "functions."
		29	Delete ", somewhat this."
7L		1	Change "glycedrol" to "glycerol."
10L	(601)-1	2	Change "i" to "in."
	(601)-1(3)		Change "enxymes" to "enzymes."
10R	(601)-3		Delete "793."
	(601)-5		Change "carcas" to "carcass."
11R		12 fr bot	Change "scs" to "sacs."
13R		14 fr bot	Change "*Gacilis*" to "*Gracilis*."
15L		26	Change "package" to "packages."
		9 fr bot	After "USDA" add "Grade."
15R		3	Change "of" to "and."
		24	Change "procession" to "processing."
		16-17 fr bot	Change "lefton" to "left on."
		25 fr bot	Change "int" to "into."
19R		11	Change "USA" to "USDA."
23L		5	Change "of" to "if."

Page-Col	Subject	Line(s)	Correction
23L		3 fr bot	Change "liens" to "lines."
23R		7	"Exercises (607):" should be in bold face print.
24L	(608)-1	2 fr bot	Change "specification" to "fabricated."
		14 fr bot	Change "occurr" to "occur."
24R		7 fr bot	Change "other" to "Other."
		14 fr bot	Change "is" to "its."
25L		9	Change "order" to "older."
27R		10	Change "the" to "The."
		8 fr bot	After "is" add "no."
		19 fr bot	Change "Characterists" to "Characteristics."
28R		9	**"hair roots"** should be in normal print.
		17	Change "Cut" to "Cuts."
31L		9	Change "*Fleshing, Fleshing*" to "*Fleshing.* Fleshing."
		18	Change "*Pinfeathers,*" to "Pinfeathers."
		5 fr bot	The second **"Bruises"** should be in normal print.
		14 fr bot	Change "brest" to "breast."
		19 fr bot	After "tears" add a comma.
		18-19 fr bot	**"Cuts, tears, and missing skin"** should be in normal print.
31R		20	Change "by" to "be."
32L		31	Change "standport" to "standpoint."
32R		21	Change "liabile" to "labile."
		28	Change "miscelaneous" to "miscellaneous."
		23 fr bot	Change "sweetners" to "sweeteners."
		25 fr bot	Change "*sweetenrs*" to "*sweeteners*."

Page-Col	Subject	Line(s)	Correction
33R		28 fr bot	Change "*picke*" to "*pickle*" and change "--" to "(."
34R		7	Change "70°" to "70%" and "50°" to "50%."
		23-24	Delete "Second pickle from fancy grades of meat is reused."
		24	Change "picle" to "pickle."
		27	Change "procedures" to "procedure."
		28	Change "25°" to "25%."
35L		25	Change "port" to "pork."
35R	(614)-1	2	Delete "is."
	(614)-2(c)	1	Change "(2)" to "(b)."
36L	(614)-2(e)	2	Change "25°" to "25%."
39R		4	Change "thus" to "Thus."
		14	Change "deteced" to "detected."
40L		20	Change "contained" to "container."
		21-22 fr bot	Delete "and increased tensile strength, lighter weight,."
40R		19 fr bot	Change "when" to "When."
41L		4 fr bot	Delete "(-23° C to -18° C)."
41R		1-2	Delete "precooked frozen in-flight meals, TV dinners, and."
43R		9 fr bot	Change "NAS" to "NAF."
		12 fr bot	Change "*m*" to "*l*."
		13 fr bot	Change "*l*" to "*k*."
		14-15 fr bot	Delete "*k*. Write to . . . its standard brands."
47R		17 fr bot	Change "correspondence" to "Correspondence."
48R	(623)-5	1	Change "or" to "of."
54R	(625)-2	3	Change "positing" to "posting."
	(625)-3	2	Change "bed" to "be."

Page-Col	Subject	Line(s)	Correction
57L		2	Change "officer" to "contractor."
		25	Change "of" to "or."
57R		21 fr bot	Delete ", which."
58R		25 fr bot	Change "ejected" to "rejected."
60R		10	Change "oversea" to "overseas."
62L	(631)-1	1	Change "Centigrade" to "Celsius."
	(631)-2	3	Change "Centigrade" to "Celsius."
		10	After "sell" add "to."
67R		19	Change "from" to "form."
69L		2-4	Delete "Often, though . . . product concerned."
70L		10	Change "of" to "at."
		11	Change "ceptance" to "acceptance."
70R		19 fr bot	Change "part of also" to "also part of."
		Last	Change "$705.00" to "$750.00."
73R		Last	Change "avoi" to "avoid."
75R		6 fr bot	Delete "and."
81R		24	Change "class" to "Class."
83L		12 fr bot	Change "observed" to "observer."
83R		6 fr bot	Delete "(T)."
		25 fr bot	Change "he" to "the."
86L		15	Change "F.D.B." to "F.O.B."
		36	Change "3000" to "300."
92L		11	Before "total" insert "the."
		19	Delete first "weight."
92R		11	Change "whose" to "those."
94L		24	Change "count" to "condition."
94R		18	Change "OSDA" to "USDA."

Page-Col	Subject	Line(s)	Correction
98L		21 fr bot	After "account" add "of."
108L		16	Change "encourages" to "encouraged."
		20	Change ", based on the product's" to "based on the use of the product and it's acceptance."
		21	Delete "and on use."
108R	(654)-6		Change "Through what" to "To whom" and change "to what" to "who are they then forwarded to."
109L		26	Change "temperaturs" to "temperatures."
109R		2 fr bot	After "105D" add a comma.
		3 fr bot	After "Rations" add a semicolon.
		15 fr bot	Change "n" to "in."
110L		18	Change "procedurs" to "procedures."
110R		36	Delete "Major,."
113L		15-20	"Rations are . . . they are not" should be in normal print."
113R		11 fr bot	Change "409" to "4-9."
116L	(658)-5	2	Change "19 77" to "1977."
119L		2-3 fr bot	Delete "a copy of."
		6 fr bot	Change "form" to "from."
		9 fr bot	Change "REport" to "Report."
119R		6	Change "Yor" to "Your."
		18	Change "inspectins" to "inspections."
		10 fr bot	Change "on" to "an."
		16 fr bot	Change "dangers" to "dangerous."
127L	600-1	7	Before "A" insert "c."
	601-1.(5)		After "(4)b" add "(5)c."
129L	629-6		Change "619-6" to "629-6."

Page-Col	Subject	Line(s)	Correction
129R	636-3		Change "False. Articles and . .. for a contract" to "True."
130L	650-3		Change "DV" to "DD."
	650-7		Delete "A" and "inspection."
130R	653-8	2	Change "AQl" to "AQL."
	654-4		Change "⩽" to "≦" and "of" to ", or" and after "defect" add a comma.

Page Changes:

Remove Pages	Insert Pages
29-30	29-30
37-38	37-38
99-100	99-100
103-104	103-104

a trier inspection. As in inspecting other meat products, you should check purchase orders and all related supporting documents to make sure that the meat conforms to all terms of the contract. Slab bacon is usually bought in 2 weight ranges: an 8 to 12 pound range and a 12 to 14 pound range. The amount of fatback removed should not exceed 1¼ inches from the scribe for a low average. A bacon slab should be at least three-quarters of an inch thick at any point except the edges. The leaf fat and excessive cartilage should be removed. Also the slab should not have unsmoked areas, hair roots, mutilations, or black seeds.

Specification for bacon. The current specification (PP-B-81) distinguishes two primary types of bacon. Of these two types, only type II (special) is procured for military use. Type I (standard), which is not purchased by the military, is basically a commercial product. Included under type II bacon are several forms, styles, and classes.

a. Type II (special)—Form A refers to slab bacon, and form B refers to sliced bacon. Type II will appear in one of the following three styles: style 1, one full slab, shingled or reformed, wrapped in wax paper; style 2, 1 pound units not vacuum packed; style 3, 1 pound units partially vacuum packed. The three classes of type II bacon are: class 1, chilled; class 2, frozen/overseas; and class 3, frozen/domestic. Inspectors should be alert to new changes and amendments to the specification.

b. Requirements for type II—uncured bellies for class 1 (chilled) and class 3 (frozen/domestic) may be frozen provided they have been stored at 0° F(−18° C) or below for less than 60 days. Total time in the smokehouse is 12 hours or more. Smokehouse temperatures may vary but will exceed 120°F (49° C) during the entire period. Class 1 products are placed and held at 40° F (4° C) or lower. Classes 2 and 3 are placed in a freezer at 0°F (−18°C) or lower within 120 hours after completion of smoking.

Hams. The ham quality determination factors of skin, fat, and lean are much the same as the factors in bacon. However, for hams, bone becomes a very important factor. The bone must not be excessively large nor excessively hard and white. Cut surfaces of the aitchbone of a young animal are cartilaginous or red, while the cut surfaces of this bone of an older animal are white and flinty. The meat from the ham of an old animal is likely to be tough. The skin should be smooth, soft, firm, and unwrinkled. The lean should be firm and have a good color. The fat should be white and not excessive. The smoked product should be brown and smooth.

Inspecting the shank. A primary off-condition to check for in hams is *souring*. The most common area for souring is in the shank end of the ham where the bones of the thigh, knee, and two lower leg bones are located. These bones are surrounded by tendons and fibrous material. It is difficult to penetrate these areas adequately with curing agents. When these areas are not adequately cured, bacterial growth may be stimulated during the smoking period and souring may result. A trier can detect this condition.

Examining the butt end. The fat on the aitchbone, row of the femur (under the aitchbone, along the femur), and the stifle joint should be checked with a *trier*. Pelvic fat is very unstable, and if any remains on the aitchbone, souring is possible.

Using the trier. The trier is an instrument that resembles an ice pick used to probe areas for sourness. It should be clean and free of any odors that might interfere with the examination. It is inserted into the areas mentioned above, then withdrawn and held under the nose to detect the odor of sourness.

Boneless Pork, Frozen. Boneless pork, frozen, for military procurement purposes, consists of the pork loin further processed into roasts and slices. Type I is the identification for roasts, and type II, for slices. The pork loin is the only market cut that is prepared as boneless pork.

The fresh, chilled, bone-in pork loins must be in excellent condition at the time of boning. They must show no evidence of such conditions as off-odor, slight stickiness, rancidity, sourness, or discoloration. The loins, before boning, must be full-cut, and trimming the lean from the loins to meet the weight range is not permitted. The internal temperature of the bone-in loins, at the thickest part, must be between 28° and 40°F (-2° to 4° C) from the time of initial chilling until they are boned. The maximum internal temperatures at the thickest part of the chilled pork loins, after boning and until the fabricated product is placed in the freezer, cannot exceed 42°F (6° C).

The color of the bones ranges from red to dark pink, with the color of the exterior surface of the rib bones showing at least a slight red color. Cartilage must be in evidence. The split chinebones, spinous processes, and crosscut sections of bones should be porous and not brittle or flinty.

The exterior fat of the loin must be firm and white. The lean should be fine-textured and firm, with at least a slight amount of marbling in the blade and ham ends. The lean meat possesses a bright, uniform color, ranging from light pink or greyish pink to bright red, and the flesh must not be dark, gummy, or oily. Finally the pork loins must be thick, uniformly full, and well-rounded. They should show no evidence of thawing, refreezing, or freezer burn.

The following carcass portions must be removed and excluded from loins used for both type I and type II fabricated pork:

- Flank meat, tenderloin, and blade meat (meat lying over the blade bone).
- Bone, cartilage, blood clots, bruises, semiattached fat, or tag ends.
- Surface fat in excess of ¼ inch in thickness.

Temperature Requirements. At the time of delivery, frozen items must show no signs of thawing and refreezing and must have an internal temperature of not higher than 10° F(−12° C) if for export use and 15° F (−9° C) if for domestic use. Chilled items must have a temperature of not more than 45°F (7° C) at the time of delivery. Products which exceed these temperatures should be rejected. In those cases where the product exceeds the required temperature but the delivery temperature is not more than 5° F higher than that required, the contracting officer may authorize the vendor to rework the product. In order for the contracting officer to authorize this rework, the vendor must immediately reduce the temperature and reoffer the product. The temperature at the time of the reoffer must be no higher than 5° F (15° C) for frozen products for export, 10° F (−12° C) for frozen products for domestic use, and 40° F (4° C) for chilled products.

Exercises (611):

1. Match each term in column B with its related descriptive statement in column A. Some responses in column B may not be used:

Column A

____(1) Not required since the skin is not removed before chilling.
____(2) Pork items remaining after the removal of the shoulder, ham, belly, and back.
____(3) Maximum fat thickness allowed on a selection No. 1 ham which weighs 15 pounds.
____(4) Minimum thickness of a bacon slab at any edge.
____(5) The USDA grade of pork that exhibits moderately thick muscling.
____(6) The USDA grade of pork that exhibits minimum degree of finish and yields high-quality cuts.
____(7) Overfat hogs that yield low proportion of lean cuts and high proportion of fats.
____(8) A ham that has its skin left on.
____(9) A ham that is partially skinned.
____(10) The entire intact rib section after removal from the belly
____(11) The name for bacon before it has been cured and smoked.
____(12) The sightly wedge-shaped portion of the pork shoulder after separation from the standard picnic.
____(13) The mammary tissue of pork bellies.

Column B

a. Backfat.
b. Type II (special).
c. Belly.
d. Seeds.
e. Type I (special).
f. Shipper style.
g. Loin.
h. Stifle joint.
i. US No. 2.
j. Spareribs.
k. Fatback.
l. Star joint.
m. Shrouding.
n. Regular loin.
o. Clear plate.
p. US No. 1.
q. Skinned ham.
r. Short-shanked ham.
s. Boston butt.
t. US No. 3.
u. Ham.
v. 1½ inches.
w. Short-shanked shoulder.
x. ¾ inch.

2. State major cause of rejection of pork.

3. At least how thick should a bacon slab be at any point except the edges?

4. Indicate a primary off-condition which you should check for in hams.

5. The maximum internal temperature of chilled pork loins after boning and until fabrication must not exceed how many degrees (Fahrenheit and Celsius)?

6. Each box of pork, boneless, frozen, type II can contain not more than what percent facing slices by weight?

7. Once fabricated pork is frozen, it must stay at a uniform temperature not to exceed how many degrees (Fahrenheit and Celsius)?

612. Supply the grade determinants used in quality grade evaluations of poultry.

Quality Grade Determinants for Poultry. In determining the quality of poultry, as in other species of meat animals, we are concerned with the palatability and/or edibility of the product. USDA has the responsibility of determining the quality of poultry and poultry products. This Department has, in turn, developed a set of determinants used in quality grade evaluation. These factors are found in the USDA publication: *Regulations Governing the Grading and Inspection of Poultry and Edible Products Thereof and U.S. Classes, Standards*

Sour round. This is a specific foul smelling fermentation and putrefactive process occurring in the ball-and-socket joint of the hindquarter of heavier beef carcasses. It is caused by slow cooling or a combination of poor chilling and poor ventilation. A meat trier is used to detect the problem by smelling the trier before and after inserting it into the ball-and-socket joint. Carcasses possessing sour rounds should be rejected and returned to the contractor. If detected after final acceptance, the procurement agency concerned should be notified, so that possible recovery action involving latent defects may be taken. If the beef is Government-owned, the rounds should be split to the bone, so that you can examine the surrounding tissue for a grayish discoloration. The grayish discoloration, if present, should be trimmed away and discarded, and the remainder of the hindquarter should be allowed to air out in a chill room. If no discoloration is present, airing the product in a chill room overnight will probably allow the off-odor and off-flavor associated with sour rounds to dissipate.

Abscesses. The encapsulation of diseased tissue by certain white blood cells is an *abscess*. There is a collection of puslike material present which is a result of the white blood cell activity. Abscesses are normally located on internal surfaces, but some may be found on external surfaces. Their presence indicates bacterial invasion or contamination, and they are dangerous when found in association with lymph glands, because this indicates a systemic disease. The USDA condemns entire carcasses for extensive abscesses, and the military rejects abscessed carcasses during acceptance inspections. If the product is Government-owned, smaller abscesses are trimmable, but larger ones may warrant throwing out the product.

Bruises. *Bruises* are blood collections associated with damaged tissue. Most bruises are superficial in nature, but some are penetrating. Since these areas are breeding grounds for bacterial spoilage, trimming is required. the disposition is normally to accept and trim, but judgment must be used in severely bruised carcasses.

Mold. Beef carcasses exhibiting *mold* are indicative of old, improperly stored products. The mold is not toxic but must be washed from the carcass. Vinegar and water are used to wash the carcass and storage area.

Cuts and mutilations. Carcasses exhibiting *cuts* and *mutilations* are produced from poor workmanship. These carcasses are subject to rejection due to poor quality. One consideration for inspectors is the effect of gross cuts on the processing of a carcass into retail cuts, since some cuts could prevent proper processing.

Anatomical Areas of Deterioration of Carcass Beef. The natural breakdown of carcass meats begins with slaughter and terminates with complete rancidity and decomposition, or else by consumption. The most important factors involved in controlled deterioration are temperature, humidity, and air cirulation during storage. If old products are delivered, rejection is in order; but acceptance with immediate issue may suffice. An important point for inspectors on acceptance inspections is that the product should not show more than normal signs of deterioration to be considered in excellent condition. This condition, of course, is a specification requirement. The areas discussed here will give sufficient indication of deterioration and can be used at origin, destination, or in storage.

Hanging tender. The *hanging tender* is located on the left hindquarter in a dressed carcass. It is exposed muscle tissue which does not drain well during bleeding and, because of its exposure, it dehydrates rapidly. With blood and serum drippings from other parts of the carcass, it may serve as a breeding ground for bacteria. Normal specification requirements are to trim this muscle to one-fourth inch, but some contracts may vary.

Jugular furrow. The *jugular furrow*, which is the pathway of the large blood vessels in the neck, is another area. The vein, which is stuck in bleeding of the animal during slaughter, is located in the jugular furrow. Blood seepage and serum in this area promotes the growth of spoilage-causing bacteria. The presence of off-odor is a good indicator of deterioration.

Diaphragm. The portion of the diaphragm remaining after dressing a carcass is called the *skirt*. There is poor air circulation under this skirt muscle, and slime is often found here. The presence of slime and off-odors indicates bacterial contamination.

Flank. The *flank* folds inward as a carcass is suspended by the gambrel tendon. This fold in the flank gives the posterior abdominal region poor air circulation and slime soon develops. The situation here progresses in like manner to slime under the skirt.

Muscle surfaces. Cross-grain cut surface muscles tend to dehydrate and deteriorate more rapidly than surfaces covered with fat. Sliming and bacterial decomposition occur in these areas earlier than in other parts of the carcass. The gracilis muscle, the eye of beef, the hanging tender, and the brisket are all exposed in quartered carcasses and can be examined for soundness or condition.

Net Weight. Carcass beef is net weighed by one of two methods according to DPSC 4155.6, *Subsistence Inspection Manual*. Weighing may be accomplished at origin and destination or as deemed necessary by the accountable receiving officer. The scales must be periodically checked for accuracy, and this requirement will vary from origin to destination. Carcass beef received directly from the vendor and all other bulk items which are to be further processed must be reweighed by commissary personnel. Any shortage will be significant, and on contracts issued by DPSC, the shortage must be reported to the Contract Quality Assurance Element (CQAE), if the value of the shortage exceeds $25.00. In those cases where the shortage does not exceed $25.00, the amount of the shortage is simply deducted from the total amount on the vendor's invoice. When the produce is a locally procured item, the shortage will be deducted from the invoiced amount delivered. Products which are not to be further processed may be weighed, using the Q-allowances. The sample size must be at least 13, and significant shortages are determined by comparing the average shortage to the Q-allowance. Instead of using the Q-allowance, 100 percent inspection should be utilzied at any time that it does not impose too great a work load or cause unwarranted damage to the product. Reporting shortages using the Q-allowance is also based on those shortages which exceed $25.00 on DPSC contracts.

Product Temperature. One of the first steps performed by inspectors at destination is to take and record vehicle and product temperature. The temperature of the vehicle is often not applicable, but the internal temperature of the product is very important.

Frozen products must show no signs of having been thawed and refrozen at the time of delivery. The internal temperature at the time of delivery should be no higher than 45° F (7° C) for chilled items, 10° F (−12° C) for frozen products for export use, and 15° F(−9° C) for frozen products for domestic use. Products which are rejected because of temperature may be reworked by the vendor, provided the temperature at the time of rejection was not more than 5° F more than the maximum temperature allowed. If a contractor decides to rework the product due to temperature, that person must immediately reduce the temperature and resubmit the product. The internal temperature of reworked and resubmitted products must not exceed 40° F (4° C) for chilled products, 5° F (−15° C) for frozen products for export, and 10° F (−12° C) for frozen products for domestic use. DPSC General Article 78 provides for this working and also specifies that reworking for temperature will not be authorized unless the product meets all other contract requirements. Temperature determinations should be made by using inspection level S-3 from MIL-STD 105D, and samples should be selected randomly from throughout the shipment. it is important to maintain this temperature; therefore, keep the vehicle secured until offloading is begun.

Exercises (615):

Name the defect or condition described in exercises 1 through 8:

1. A condition defect caused from glycogen depletion prior to death.

2. Heavy accumulations of connective tissue resulting from a healed injury.

3. Two different colors on lean in the eye of beef.

4. A foul smelling defect found in the ball-and-socket joint of the hindquarter of beef.

5. Blood collections associated with damaged tissues.

6. Dark spots of hemorrhage evident throughout the tissue of the eye of beef.

7. The encapsulation of diseased tissue by white blood cells.

8. Indicative of old, improperly stored products.

Provide the proper term or phrase answering each following question concerning anatomical areas of deterioration, net weight determination and temperature determinations:

9. To what must the hanging tender be trimmed?

10. Natural deterioration of item No. 102 forequarter can best be determined by examining what?

11. What is the portion of diaphragm remaining after dressing called?

12. Surface areas covered with fat deteriorate at a less rapid rate than what other surfaces?

13. When inspecting a shipment of carcass beef, you find a significant net weight shortage. What should you do in these circumstances?

14. Using Q-allowance net weight determinations, what is the least size a sample must be?

15. What should product internal temperature of a chilled product not exceed (in Fahrenheit and Celsius)?

16. During a class 4 inspection of carcass beef, you find a sour round. What should you recommend?

may be "rounded off" to the nearest dollar in accordance with DPSC Manual 4155.12A Computation Guide.

DD Form 1234, Report of Inspection of Subsistence Products. The DD Form 1234 is prepared for each origin (class 3 inspection) lot whenever AQLs and Tables of Defect Classification are not contained in the Quality Assurance Provisions of the end item specification, for shipments of preaward inspection lots, for transshipments for freezing, and for destination rejections or other inspections where another DD form is not applicable.

The destination QAR (perishable and nonperishables) must prepare DD Form 1234 only as required for local use. Inspection personnel not signing the inspection block of the receiving report should insure that the authorized government representative completing this report is furnished with a complete copy of DD Form 1234, or the appropriate information therefore, including discrepancies that require contractual actions. In destination inspections without discrepancies, furnishing DD Form 1234 should be mutually agreed upon with the receiving officer. Block by block instructions on the completion of the DD Form 1234 is outlined in DPSCM 4155.6, Subsection 213.6.

DD Form 1232, Quality Assurance Representative's Corespondence. The DD Form 1232 is used to make a narrative report of the inspection of subsistence and will normally be forwarded to another quality assurance representative. The completion of this form is relatively self-explanatory.

DD Form 1608, Unsatisfactory Material Report (Subsistence). The DD Form 1608 is the form to use when reporting unsatisfactory subsistence that is owned by the Government, the cause for the unsatisfactory nature of the subsistence of which was beyond the control of your base. Step by step instructions on the completion of the DD Form 1608 can be located on the back of the DD Form 1608 and in the Consumer Level Quality Audit Program Handbook (COLEQUAP). An officer should sign the report. If two agencies collaborate in the submission of a UMR; e.g., Food Service and Environmental Health Services, both officers should sign the 1608. The completed DD Form 1608 is submitted through the command Environmental Health officer to Air Force Engineering and Services Center.

AAFES Form 6500-20, Subsistence Inspection Report. The AAFES Form 6500-20 should be utilized to report nonconformances of Exchange Service products. You should immediately call the activity manager and advise that a nonconforming shipment is being delivered. The facility manager will determine whether the product will be rejected or accepted. You should complete the AAFES Form 6500-20 in four copies, listing the products involved, the reasons for nonconformance, the quantities involved, contractor information (address, etc.), and the facility manager's decision on disposition of the identified products. The original of the AAFES Form 6500-20 is sent to the contracting officer; copy 1 is sent to the exchange facility involved in the disposition decision, copy 2 is sent to the AAFES regional office responsible for your AAFES region, and copy 3 is used as your file copy.

DD Form 250, Material Inspection and Receiving Report (MIRR). This is the form normally used as an invoice for nonperishable subsistence. It should be prepared by the contractor and be signed by the origin and destination inspectors when the supplies are acceptable. Destination inspectors will find the MIRR used as a receiving report for shipments under a DD Form 1155, Order for Supplies or Services/Request for Quotations, and when DPSC Form 300s, Order for Subsistence, have been lost or are otherwise missing. In the latter cases the commissary officers will prepare the form. The use and preparation of the form is covered in DPSC Manual 4155.6, subsection 213.5.

DPSC Form 300-2, Receiving Report of Order for Subsistence. The DPSC Form 300-2 is located on the back side of the DPSC Form 300 and is used to annotate items received, nonconformances, and rejections associated with this specific DPSC Form 300. The DPSC Form 300-2 must be signed by the inspector and the receiving agent.

DD Form 1155, Order for Supplies or Services/Request for Quotations. The Form 1155 is used to identify requirements on products purchased as local purchase items.

Exercises (651):

1. Match each situation/purpose in column B with its related form numbers in column A by placing the correct letter in the blank provided. Column B selections may be used once, more than once, or not at all.

Column A

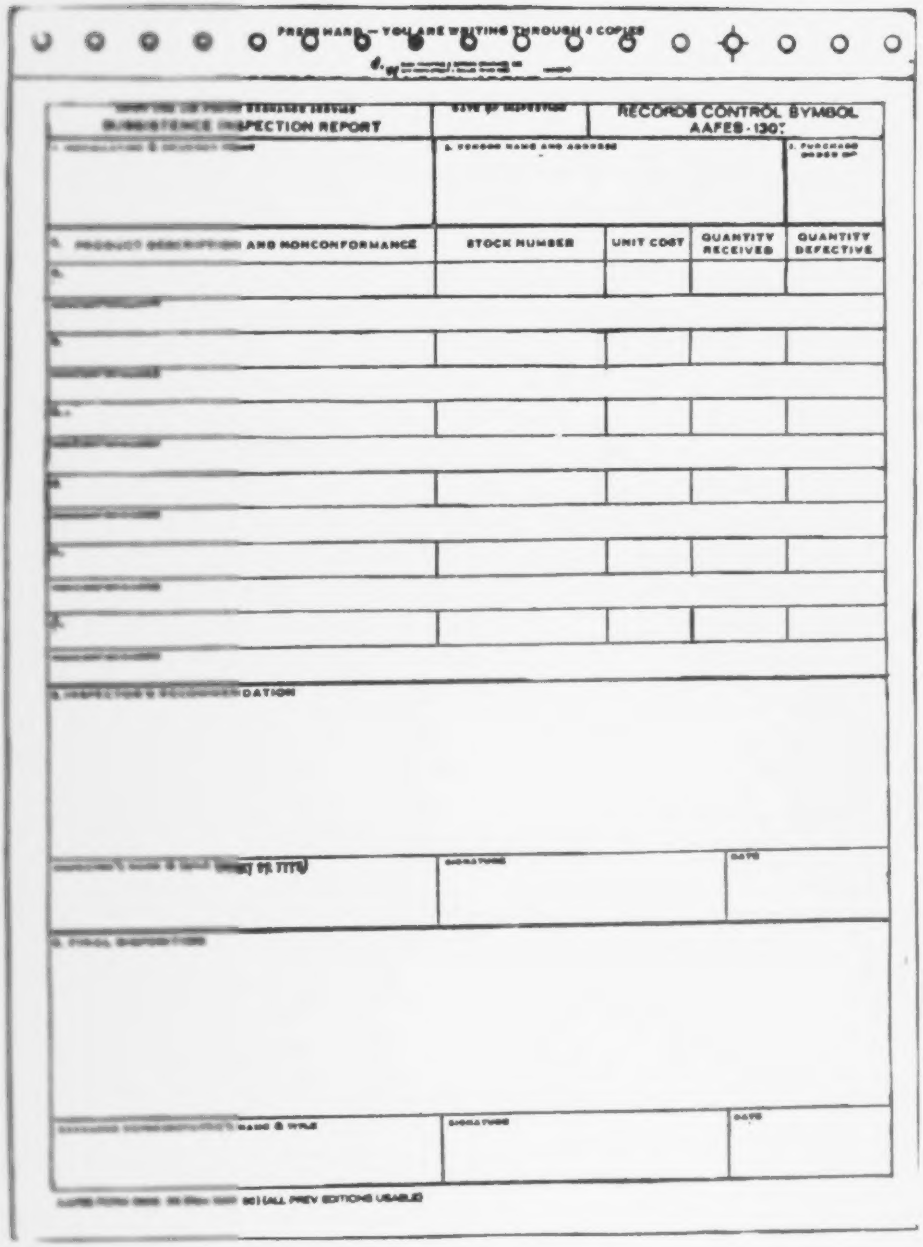
— (1) DD Form 1234.
— (2) DD Form 1232.
— (3) DD Form 1608.
— (4) DD Form 250.
— (5) AF Form 1148.

Column B

a. Reporting subsistence inspections at origin when no AQLs are given.
b. Used to report damage of Government supplies on Government carriers.
c. Used for corresponding with other inspectors.
d. Used to document rejections of class 4 resale items.
e. Daily food inspection record class 3.
f. Reporting of inedible foods during class 5 inspection.
g. Daily food inspection record classes 4 and 8.
h. Material Inspection Receiving Report.

4-4. Consumer Level Quality Audit Program (COLEQUAP)

THE CONSUMER level quality audit program (COLEQUAP) and its purpose have seemed to confuse and irritate food inspection personnel since this program's inception over a decade ago. The confusion and irri-



PRESS HARD — YOU ARE WRITING THROUGH 4 COPIES

SUBSISTENCE INSPECTION REPORT		RECORDS CONTROL SYMBOL AAFES-130

AND NONCONFORMANCE	STOCK NUMBER	UNIT COST	QUANTITY RECEIVED	QUANTITY DEFECTIVE

DATION

TITLE	SIGNATURE	DATE

NAME & TITLE	SIGNATURE	DATE

(ALL PREV EDITIONS USABLE)

Figure 4-2 Sample of AAFES Form 6500-20.

QUAP sampling plans are developed from tables in MIL-STD-105D, Sampling Procedures and Tables for Inspection by Attributes. AFR 74-10 states that a single sampling plan with a normal severity of inspection is used. Remember to check your Quarterly Program Notes for any change to this instruction. Examinations and tests to be performed are stipulated in the program instructions for each audit item. The sampling plan criteria; i.e., levels of inspection, AQLs, expression of lot size, and sample units, are normally the same ones stated in the end item criteria table; this table is normally found in the quality assurance provisions section of the applicable product specification. When developing a sampling plan, do not forget that, if Major A defects are listed in the quality assurance provisions of the specification and no AQL has been specified in that table, then an AQL of 0.0 must be entered on the AF form 2063. You must enter an AQL of 0.0 for each table of examination required by the Quarterly Program Notes when a Major A defect is not assigned an AQL. Again, some criteria may be changed by the Quarterly Program Notes, and you must review the Notes before you proceed.

Before a sampling plan can be extracted from MIL-STD-105D for each AQL, the lot size for the audit must be determined both for the overall audit and for each table of examination. The specification tells you what units you must consider in order to determine lot sizes. Be careful not to confuse the units used for determining lot size with those used to determine sample units; they are often different within the same table of examination. Also be careful to review each table prior to recording a lot size. The number of units that constitute a lot size is the number of units in commissary storage from one contract and lot. When a Major A defect assumes an AQL of 0.0, the sample size for that AQL will be the largest sample size determined for any other AQL in that table of examination will be assigned to the 0.0 AQL. The accept number in this case is always 0.

If the lot size is so small that all assigned AQLs have sample sizes that exceed it, a 100 percent inspection is preformed on the entire examination. When 100 percent inspection must be used and the accept/reject numbers on the AF Form 2063 do not apply, you note this in the remarks section of the AF Form 2063. As we set up a sampling plan and look forward to the actual examination of the product we must be familiar with the process of examining the product and calculating the probability of acceptance.

Product Examination. Samples must be selected by random sampling technique. Use the table of random numbers or a method equal to it, assuring that each unit in the lot has an equal chance of being selected.

Since COLEQUAP is an audit of Government-owned subsistence at the user level, all foods inspected should be used in the menu. This requires careful planning and close cooperation with food service and commissary personnel. Perform examinations at the commissary warehouse or cold storage plant when possible. Examinations of the product in the thawed or prepared state are accomplished before the item is served in the dining hall. Examine the sample units for all defects listed in the end-item examination requirements found in the Quarterly Program Notes. These examinations are found in the quality assurance provisions of the product specification or the Quarterly Program Notes.

Probability of Acceptance. The probability of acceptance is a statistical means of projecting the quality of the examined lot. In COLEQUAP, probability of acceptance is abbreviated "Pa," and is expressed in gradients from worst to best probability. The worst Pa would be less than, or equal to (≤) 5 percent. The best Pa would be greater than (>) 25 percent. The probability of acceptance should not be confusing, but if confusion does exist, let us explain it here. If the product which we have statistically sampled and inspected has a Pa of less than or equal to 5 percent, we are assuming that the product could be sampled and tested 100 more times and would pass these inspections only five times. In other words, it would fail the inspection 95 times, or have a probability of failure of 95 percent.

Pa's are computed using the tables found in the *COLEQUAP Handbook*. Pa's must be computed for all AQLs for which defects have been found during examination. The exception to this rule would be any AQL which has been expressed as 0.0. You never compute a Pa for an AQL expressed as 0.0.

After computing Pa's for each applicable AQL, select the lowest Pa (worst Pa) determined. This Pa becomes the overall Pa for the audit.

Exercises (653):

1. What agency is responsible for selecting items for COLEQUAP audit?

2. Who is responsible for validating the accuracy of COLEQUAP reports and forwarding the consolidated report to AFESC?

3. What publication contains specific instructions on completion of the AF Form 2063, Individual COLEQUAP Report?

4. In case of conflict between documents required for COLEQUAP, which document takes precedence over all other?

Using supplementary materials (Appendix A, Sampling Plan Tables), determine the sample size and accept or reject numbers for the following, involving items 5 through 8:

SAMPLE SIZE *ACC NUMBER* *REJ NUMBER*

5. Lot Size: 20
Inspection Level: S4
AQLs: 1.5 Major B
4.0 Minor

6. Lot size: 13
Inspection Level: I
AQLs: 1.0 Major B
10.0 Minor

7. Lot Size: 52
Inspection Level: S3
AQLs: 2.5 Minor B
6.5 Minor

8. Lot Size: 440
Inspection Level: II
AQLs: 4.0 Major
10.0 Minor

654. Specify the form(s) for reporting COLEQUAP results and publication(s) giving instructions for completing them.

Air Force Form 2063, Individual COLEQUAP Report. Results of COLEQUAP audits are submitted in accordance with AFR 74-10. This regulation requires that audits be reported to AFESC through the MAJCOM Environmental Health officer on AF Form 2063. The major command will collect all audit reports; screen the data with regard to commodity use, quality, acceptance, and accuracy; and forward them to AFESC. The AF Form 2063 must be completed legibly in pencil. One original copy will satisfy AFESC requirements. Instructions on additional copies must come from the MAJCOM Environmental Health officer. Detailed instructions for completing the AF Form 2063 are found in the COLEQUAP Handbook. These instructions must be followed exactly to insure accuracy. A sample copy of AF Form 2063, properly completed is shown on figures 4-3 and 4-4.

DD Form 1608, Unsatisfactory Material Report (Subsistence). Subsistence items are considered unsatisfactory when found to be unwholesome or unfit for their intended use. They are reportable if these conditions or factors are beyond normal base control. A food unfit for its intended use may be edible, but the defects may preclude its use as required by the menu. This most often results from failure of the item to meet procurement specification requirements or failure of the specification to protect against the defects or conditions found.

The UMR (DD Form 1608) is prepared and submitted when inspection indicates a Pa equal to or less than 5 percent (< 5%), when the food item is not serving its intended purpose, or when a Major A defect is found for other than packaging or marking defects, or when the marking is missing or illegible. The UMR is to be completed in accordance with with instructions in the *COLEQUAP Handbook* and on the back of DD Form 1608. An example of a properly completed form may be found in figure 4-5.

When completing this form, use the product nomenclature from the packing case. Report in block 15 only those tables of examination or paragraph examinations where the product is nonconforming. Nonperishable subsistence has codes that must be cited in block 17 of the form. These codes (A, B, and C) are applied to Government-owned subsistence and can be found in block P of DD Form 1348-1, Single Line Item Release/Receipt Document, which is received with the shipment. The classifications are:

a. A—new material issuable without limitation or restriction.

b. B—new material with limited usefulness or short life expectancy.

c. C—serviceable material for priority issue and normally restricted to CONUS activities.

When completing the UMR, enter in block 17 the date the unsatisfactory material was received at your base and the amount of the product remaining in stock. Attach the completed AF Form 2063 to the UMR. It behooves the initiator of a UMR to be selective in the comments placed in block 18. Phrases such as "Tighten origin inspection" and "Closer surveillance at origin" are of no value. In reality, origin inspectors are limited by MIL-STD-105D and DPSC Inspection Manual 4155.6, (Subsection 225, as to when they can apply tightened inspection procedures. In many instances, the origin inspector did, in fact, provisionally reject the product, but the contracting officer accepted the product with a price adjustment. In other instances because of the procedures of contractor inspection, it is possible that the Government origin inspector did *not* perform verification inspection on the lot that included the unsatisfactory material. It is also possible that the product

CHANGES FOR THE TEXT: VOLUME 5

Pen-and-Ink Changes

Page-Col	Subject	Line(s)	Correction
3R		6 fr bot	After "nature" add "of."
6R		4 fr bot	After "tornado" add "is."
		23 fr bot	Change "Texax" to "Texas."
10L		2	Change "eruptions" to "eruption."
		17	After "of" add "a."
10R		25	Change "firesafety" to "fire safety."
11R		6	Change "airblast" to "air blast."
13L		13 and 14 fr bot	Change "weapons" to "weapon."
14L		32	Change "thorugh" to "through."
15L		9 fr bot	After "by" add "a."
15R		31	Change "contaminated" to "decontaminated."
18	Table 2-2	First block under Action	Change "piant" to "paint."
19L		21	Change "might be" to "such as."
		5 fr bot	Change "Services" to "Service."
19R		16	Change "coldstorage" to "cold storage."
		17	Change "kitchen" to "kitchens."
20L	(807)-1		Change "Environmenta" to "Environmental."
22	Table 3-1 Right Col.	5	After "over" add "-."
22R		5 fr bot	Change "radiological" to "radiologically."
26R		24 fr bot	Change "capbility" to "capability."
		2 fr bot	After "up" add "with."
31	Fig. 3-8		Change "ADUSTABLE" to "ADJUSTABLE."
	Fig. 3-8	Legend	Change "to" to "top."

Page-Col	Subject	Line(s)	Correction
33L		4	After "clothing" change "," to ";."
34	Fig. 3-11	Legend	Change "scintilallation" to "scintillation."
34L		9	Change "raioactive" to "radioactive."
37L		10	After "not" add "only."
38R		13	Change "disensary" to "dispensary."
41R		24	Change "byproduct" to "byproducts."
47L		6 fr bot	Change "cothing" to "clothing."
47R		23	Change "preent" to "present."
50R		11	Change "praticularly" to "particularly."
52R		20	Change "the" to "The."
		27	After "limitations" change "The" to "the."
53	Fig. 5-1		Change "Lewsite" to "Lewisite."
59L		25	After "capsule" change "l" to "I" and after "V" add "agents."
		26	Change "ll" to "II."
61R		38	Change "bocarbonate" to "bicarbonate."
63L	(822)-2		Change "con" to "decon."
72L	811-1	5	Change "contamination" to "decontamination."
72R	814-1	1	Change "out" to "our."
73L	818-8	1	Change "thoat" to "throat."

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CDC 90850

ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

Volume 1

Control of Communicable Diseases

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Preface

IN THE 90830 Course you learned that your career field is a broad one with many challenges and many opportunities. In this first volume of CDC 90850 you will study about the USAF Medical Service, its mission and your career field and its mission. You will also study about the administration of the environmental health service office. The rest of the volume will look closely at how to control the spread of communicable diseases. In Chapter 2 we will be reviewing basic principles of biology. In Chapter 3 you will study the principles of epidemiology. Chapter 4 will cover a basic knowledge about some food and waterborne diseases you may be required to investigate at your base. Chapter 5 covers how airborne diseases are spread, and this chapter will address in detail the AF TB Detection and Control Program. Chapter 6 discusses sexually transmitted diseases and the AF STD Control program. In Chapter 7, you will study how arthropods are important as vehicles in disease transmission. And lastly, Chapter 8 discusses field hygiene and how to control disease transmission in the field.

In Volume 2 of your CDC you will study the effect that the various toxic materials produced by industry may have on the human body and what we can do to protect the worker. Volume 3 discusses the importance of facility sanitation and environmental surveys. You will read about what you should be looking for on your surveys as well as how to make recommendations for improvement. Volume 4 addresses the major aspects of food inspection and technology. Here, you will read about how food inspection duties relates to protecting the public health. Volume 5 covers the many facets of medical readiness. It discusses the types of disasters as well as how to respond to them.

For easy reference, Appendix A, which describes medical terminology, and Appendix B, which lists the biostatistic calculation formulas covered in this volume, are printed and bound in the back of this volume. They will serve as valuable tools when used in working many of the communicable disease programs.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

NOTE: If you know this course contains erroneous or outdated information or does not provide the knowledge that the current Specialty Training Standard (STS) requires you to have for upgrade training, contact your unit OJT advisor and fill out AF Form 1284, Training Quality Report. If you need an *immediate* clarification of information in these study materials, call the author between 0730 and 1615 (CT), Monday through Friday.

Consult your education officer, training officer, or NCO if you have questions on course enrollment or administration, Your Key to a Successful Course, and irregularities (possible scoring errors, printing errors, etc.) on the volume review exercises and course examination. Send questions these people can't answer to ECI, Gunter AFS AL 36118-5643, on ECI Form 17, Student Request for Assistance.

This volume is valued at 45 hours (15 points).

Material in this volume is technically accurate, adequate, and current as of September 1984.

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5 Airborne Diseases 76

6 Sexually Transmitted Diseases 84

7 Medical Zoology 100

8. Field Sanitation 131

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Appendixes 151

Answers for Exercises 159

NOTE: This course teaches through numbered lesson segment, each containing a behavioral objective, text, and exercises. The objective sets your learning goal. The text gives you the information you need to reach that goal, and the exercises let you check your achievement. When you complete each segment, see whether your answers match those in the back of the volume. If your response to an exercise is incorrect, review the objective and its text.

The USAF Medical Service Mission and Organization

THE ENVIRONMENTAL health career field, formerly the USAF Veterinary Service, is undergoing a critical period of change. The information you received during your formal technical training is basic to any further understanding of your career field mission and your responsibilities and specific duties as an environmental medicine specialist. Keep in mind that changes take time. Any reference to veterinary publications in this 90850 CDC is intentional and not a typographical or technical error. Remember the old adage, "If it works, don't fix it."

We welcome you as a part of the USAF Medical Service. We hope your service will be rewarding to you and beneficial to the USAF Medical Service. As in all serious undertakings, your reward will be equal to the effort you place in your duties.

More welcomes are forthcoming, but first let's take a look at the USAF Medical Service and discover what overall mission your career field team helps to accomplish.

1-1. Mission of the USAF Medical Service

AFR 20-28, *The Medical Service*, describes the USAF Medical Service mission as follows: ". . . to provide the medical support necessary to maintain the highest degree of combat readiness and effectiveness of the Air Force."

001. State the mission of the USAF Medical Service and its several components and explain how those missions relate.

Purpose. Think of the words "combat readiness and effectiveness" for just a moment. Taken in context with the world situation and our changing roles as military members, that standard phrase from an Air Force regulation takes on a much greater significance. Think of what those words mean in your day-to-day routine. You are an Air Force medical specialist with a personal and moral responsibility for assisting in the maintenance of the combat readiness and effectiveness of the United States Air Force — regardless or the specific medical duties you perform — by faithfully accomplishing your assigned tasks to the best of your ability and knowledge.

We perform our assigned task of maintaining the Air Force's combat readiness and effectiveness by helping to protect the general health of the Air Force member. This is done through prevention or correction of a medical problem. For example, computer cards are periodically issued from computers at base level that require you to report to the base medical facility for routine dental or medical examinations. This is an example of preventive care. Corrective medical care is when you are provided with complete medical care in the event of personal illness or injury.

Organization. You need to know how your efforts fit into the total effort of the organization to which you're assigned. Figure 1-1 is an organization chart for the USAF Medical Service. It illustrates the basic structure of the USAF Medical Service and shows that your section fits under "Aerospace Medicine" or "Aeromedical Services." It also demonstrates your basic chain of command within the USAF Medical Service.

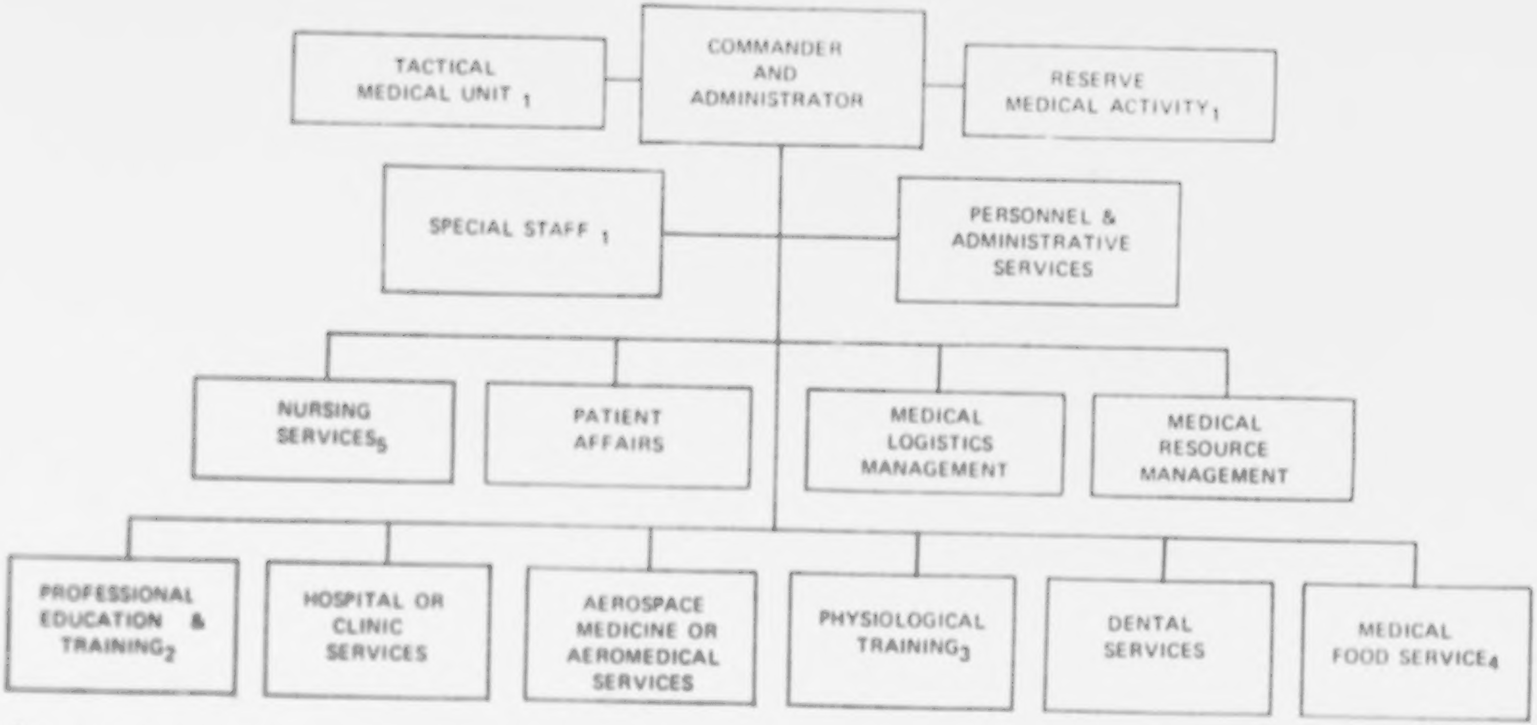
The organization of the USAF Medical Service is designed to train and equip medical personnel to provide and maintain medical health services to the United States Air Force — to provide the medical support necessary to maintain the highest degree of combat readiness and effectiveness of the Air Force. The primary objective of this organization plan is to maintain a structure in peace to avoid organizational confusion during transition to war, and to maintain a structure that operates effectively with the least expenditure of resources. It helps to standardize organization throughout the Air Force. Standardization helps reduce orientation time as we are transferred from one duty location to another. Additionally, it promotes organizational stability and helps supervisors establish standards for evaluating performance. It helps improve management technique throughout the USAF Medical Service and improves communications so all Air Force personnel will attach the same meanings to the same terms. Again, what does this mean to you? An orderly transition into the Air Force; an orderly orientation into your assigned duties and duty location; easily understood performance standards that you are aware of as soon as you begin your duties; a clear chain of command; and fair comparison with all environmental medicine specialists. It insures that you are treated in a fair, consistent manner throughout your Air Force career.

Objectives of the Aerospace Medicine Program. You must know the functions controlled by the chief of aerospace medicine for two reasons:

(1) Your duties as an environmental medicine specialist directly impact on the quality with which the mission of the Aerospace Medicine Program is accomplished.

(2) Your duties enhance and clarify other portions of the Aerospace Medicine Program for the chief of aerospace medicine.

The Aerospace Medicine Program varies from base


COMMANDER AND ADMINISTRATOR
TACTICAL MEDICAL UNIT 1
RESERVE MEDICAL ACTIVITY 1
SPECIAL STAFF 1
PERSONNEL & ADMINISTRATIVE SERVICES
NURSING SERVICES 5
PATIENT AFFAIRS
MEDICAL LOGISTICS MANAGEMENT
MEDICAL RESOURCE MANAGEMENT
PROFESSIONAL EDUCATION & TRAINING 2
HOSPITAL OR CLINIC SERVICES
AEROSPACE MEDICINE OR AEROMEDICAL SERVICES
PHYSIOLOGICAL TRAINING 3
DENTAL SERVICES
MEDICAL FOOD SERVICE 4

[1] If authorized by HQ USAF.

[2] Authorized only at medical treatment facilities with graduate teaching program. Includes medical library.

[3] Exception: At bases where the Physiological Support Division (PSD) provides pressure suit equipment for special high altitude missions, the Chief of the PSD may be directly responsible to the Chief of Aerospace Medicine; Aeromedical Services.

[4] If authorized a Dietitian.

[5] May be authorized by MAJCOM HQ for small medical facilities where no full-time Chief of Hospital or Clinic Services is authorized or assigned.

Figure 1-1. USAF Medical Service organization chart.

to base, depending upon such factors as population, geographic location, and mission. The program varies in name to comply with the Air Force Chief of Staff's policy on the use of the term "aerospace." The title *Aerospace Medicine Service* is used when one or more operational systems are supported by the medical facility, one of which must be either a ballistic missile system or space system. The title *Aeromedical Service* is used when only aircraft systems are supported. There are many areas of professional concern within the Aerospace Medicine Program — too many to discuss adequately in this volume. AFR 161-33, *The Aerospace Medicine Program*, states the varied areas of professional concern and the objectives of the Aerospace Medicine Program, which are to:

a. Promote and maintain the health and well-being of Air Force personnel.

b. Assess the effects of Air Force operations on health and the environment.

c. Ensure the quality of occupational and community environments.

So much of the work towards improving the quality of our daily lives depends on our performing our assigned tasks. We really do make a significant impact on the effectiveness and combat readiness of our Air Force.

The Aerospace Medicine Council. This unique program, contained within the Aerospace Medicine Program, allows for continued review of the activities within Aerospace Medicine and provides for systems to identify and correct potential problem areas. As directed in AFR 161-33, the council must (1) set objectives for the base Aerospace Medicine Program; (2) determine methods for improving the base Aerospace Medicine Program; and (3) plan, coordinate, review, and set medical requirements for functional areas within the Aerospace Medicine Program.

The agenda for the Aerospace Medicine Council meetings must be sent to the chairperson in time to be published and distributed to all members at least 1 week before a formal meeting occurs. In addition, minutes of the meetings must be sent to the Director of Base Medicine Services (DBMS) for review and approval.

What does all this mean for you? The Aerospace Medicine Council provides the linkage for all the functions within the Aerospace Medicine Program. It coordinates and standardizes your activities, as well as the activities of all the other personnel within the program, so that no effort is wasted, misdirected, or ignored as a learning experience.

Major functional areas in the Aerospace Medicine Program. There are three major functional areas, or programs, within the Aerospace Medicine Program. Each carries on a specific number of activities related to the overall mission of the Aerospace Medicine Program and the mission of the USAF Medical Service.

The Flight Medicine Program. The Flight Medicine Program directly supports the primary mission of the USAF Medical Service by providing comprehensive medical services for aerospace operations. The program applied to all aircrew members and others whose duties require special medical qualification. As an example of the latter, if you wish to apply for a special duty that requires specific physical attributes — say . . . 20/20 vision, full rotation of all limbs, and the like — then you must go to the people in flight medicine to schedule the required physical examinations (usually done at the physical examination and standardization section (PES) in your medical facility). Along with the obvious duties that flight medicine personnel must perform to support the flying mission, you have duties as an environmental medicine specialist. Here are two examples:

(1) Flight medicine personnel are required to ensure the environmental quality of squadron, alert, and other operational support facilities.

(2) Flight medicine personnel are required to provide support to the environmental health officer regarding the treatment of flying personnel and in solving aerospace medical problems.

The physical examinations and physical standards section (PES) of the Flight Medicine Program is probably where you will make the most frequent contact with flight medicine personnel. As was mentioned earlier, this is the area where all physical examinations are scheduled, documented, and monitored. The PES in your medical facility will be performing audiometric (hearing) tests. It is an Air Force requirement that these tests be performed by a qualified hearing conservationist (certification is received by attending the Hearing Conservation Course given at the USAF School of Aerospace Medicine, Brooks AFB, TExas). AFR 161-33, *The Aerospace Medicine Program*, outlines all of the responsibilities of the Flight Medicine Program. As you become familiar with this regulation, you will see many ways in which the Flight Medicine Program coincides with your own career field.

Bioenvironmental Engineering Program. The Bioenvironmental Engineering Program supports the USAF Medical Service mission by meeting the following responsibilities outlined in AFR 161-33:

a. Evaluates community and work environments and suggests ways to modify the environment to maintain and promote health and well being.

b. Establishes and conducts environmental monitoring programs to comply with all applicable pollution standards.

c. Responds to peacetime and wartime disasters to control environmental and health hazards.

It is Air Force policy that each employee on an Air Force installation, or those participating in Air Force projects, etc., be provided with a safe and healthful work environment. The bioenvironmental engineering section (BES) evaluates continuing activities and planned activities to ensure that Air Force policy is met. The BES evaluates facility and process plans; they do continuous environmental quality surveys in work areas as well as special environmental surveys that may be required as a result of annual workplace evaluations. Their role is one of continual observation, evaluation, and reporting. In many instances, the Environmental

Health Service (ENS) will use their reports as the basis for actions for which we are assigned responsibility. In a later volume, we will discuss just what that means in detail, but for now, you really only need to see how the functions of BES relate to Environmental Health Services.

The Environmental Health Program. This is your area of responsibility. What you may not know is how we provide support to the USAF Medical Service mission. Let's take a brief look at what AFR 161–33 says the objectives of our program are.

The program objectives for the Environmental Health Service are:

a. To prevent and reduce injury and illness.

b. To monitor the health of military and civilian workers on an installation.

c. Educate workers as to how they can prevent occupational injuries and illnesses.

d. Inspect foods and food service facilities to prevent the spread of illness.

e. Inspect places where the base population may assemble so that disease and injury may be prevented.

f. Identify insect and rodent populations that may be carriers of disease.

Program relationships. To provide a few examples of how these separate programs relate, we're going to describe a few hypothetical incidents which we'll say have occurred at Walt Disney AFB, New Jersey.

Example One: A new jet engine repair facility is being constructed at Walt Disney AFB. As part of the ongoing approval procedure for this facility, the BES has been evaluating the plans for the facility. As these plans are received at the Walt Disney AFB clinic, the officer in charge (OIC) of the environmental health office reads through each to determine what types of injury potentials may exist when the facility begins operation; how the operation of the facility might affect the local community; and what portions of the Occupational Medicine Program will need to be geared up to meet this new concern. As the facility begins operation, the OIC will need the assistance of the personnel in PES to perform physicals on the workers employed in the facility to insure that their health is being safeguarded.

Example Two: An employee of the Fabrications Plant at Walt Disney AFB has been given a hearing test by PES. The test indicates a significant hearing shift, or deterioration. The personnel in the environmental health office, after monitoring the audiograms performed by PES, notify the BES that a survey on noise levels in the plant might need to be done. Meanwhile, the personnel from Environmental Health Service will go down to the plant to see exactly what is, or isn't, being done to protect the hearing of personnel there.

Example Three: The PES finds that a significant number of aircrew members are reporting to sick call with respiratory ailments. The environmental health office identifies the dormitory for these Air Force members as a likely source of this infection and requests a survey from BES. The BES survey indicates that the ventilation system in the dormitory is contaminated with an airborne organism. AFter decontamination of the ventilaton system, the incidence of respiratory problems among the residents of this dormitory ceases.

Putting this entire concept into simple terms is difficult, but here goes: The Flight Medicine Program is concerned with the body, the unit that is experiencing the injury or illness. The Environmental Health Program is concerned with all of the bodies that make up the population of a base and how the illnesses or injuries relate to the overall health and well-being of that population. The Bioenvironmental Engineering Program is interested in all nonphysical conditions (noise, chemical, or other) that have induced the injuries or illnesses identified as a trend by the Environmental Health Program.

As you may have gathered from these examples, all the functions of the Aerospace Medicine Program are dependent upon one another. The charge to protect the health and well-being of the military member is a serious one, and can only be accomplished by a coordinated effort on the part of all sections of the Aerospace Medicine Program. You are part of that team — a team dedicated to the prevention and control of disease and injury — and your team members will rely on you, just as you rely on them, to get the job done.

Exercises (001):

1. What is the mission of the USAF Medical Service?

2. List one area where the Flight Medicine Program helps to support the Environmental Health Program.

3. Which program within Aerospace Medicine suggests ways to modify the environment so as to promote the health and well-being of the base population?

4. List one area in which the Bioenvironmental Engineering Program is supporting the Environmental Health Program.

5. The identification of disease vector populations is an objective of which Aerospace Medicine Program?

6. What specific duty section in the Flight Medicine Program would perform audiograms on industrial workers?

7. What specific program objective of the Bioenvironmental Engineering Program is met when BES participates in a nuclear weapons accident exercise?

8. Briefly describe the relationship among the three major functional areas of the Aerospace Medicine Program, and hwo that relationship supports the overall mission of the USAF Medical Service.

1-2. Environmental Health Service Relations with Other Agencies

While the EHS worker is trained to "handle" any problem, or need, which may arise during the course of a duty day, we do need the assistance of agencies outside of the Air Force in order to do our jobs as best as possible. It is also logical to use these agencies that exist outside the military structure because we deal with civilian communities at times, and these communities are not subject to military rules and regulations. We need the guidance provided by the agencies that do set rules and regulations for the civilian community.

002. Identify ways that federal agencies associated with the environmental health office could provide assistance.

Federal Public Health Agencies. The Federal Government sets health standards for most aspects of our lives, it also surveys and makes recommendations on the general public health, its status, and ways it can be improved. There are various agencies assigned these tasks, and we will now discuss some of those you will come in contact with while performing your duties as a member of the Environmental Health Service.

United States Department of Health and Human Services (USDHHS). The USDHHS is comprised of several agencies concerned with the public health.

a. The Food and Drug Administration (FDA) is a major portion of the USDHHS. Within the FDA, the Bureau of Foods designs and enforces programs that guarantee the quality and safety of foods. The FDA also enforces mandatory provisions of laws and regulations relating to food service operations, and shares responsibility for inspection of food-processing plants with the United States Department of Agriculture (USDA).

b. United States Public Health Services is also a portion of the USDHHS. This agency produces regulation and guidance in the area of National public health and provides training and education in such areas as nutrition, hygiene, and disease prevention.

Environmental Protection Agency (EPA). The EPA is responsible for designing and enforcing programs that guarantee the continued safety and purity of our environment. The air and the water, and active prevention of their pollution, are the domain of the EPA. Regulations written by EPA are a portion of the documents used by the Air Force in protecting the base environment.

Centers for Disease Control (CDC). The Centers for Disease Control, located in Atlanta, Georgia, is a field agency of the United States Public Health Services. The center investigates outbreaks of foodborne illness, studies the causes and control of disease, publishes statistical data like the *Morbidity and Mortality Weekly Report* that your office receives, and provides educational services in the field of sanitation.

Federal Food Inspection Agencies. The food inspection program provided by the Environmental Health Service involves a great amount of interaction between local, state, and federal inspection agencies and your food inspection office. Many of the publications used to inspect foods on a military installation are written and used by these agencies in civilian inspection programs.

United States Department of Agriculture (USDA) The USDA is responsible for inspection and grading of meat, meat products, poultry, diary products, eggs and egg products, and fruits and vegetables shipped across state boundaries. As mentioned earlier, some of its inspection responsibilities overlap with the FDA. It can be said that virtually every food found on your grocery shelf has received some form of inspection during production, processing, and shipment.

The United States Department of Commerce (USDC). The USDC, through its National Marine Fisheries Service, provides a program of voluntary inspection of seafoods and their processing plants, as well as the waters from which they are harvested. They also provide grading of seafoods as a voluntary program. The standards developed by this agency are noncompulsory but are used by many seafood producers.

Federal Occupational Safety and Health Agencies. Again, the Environmental Health Service finds many areas of interaction with occupational safety and health agencies — for guidance, regulatory clarification, assistance — and in areas such as training. Two of the most commonly used agencies are the Occupational Safety and Health Administration and the National Institute of Occupational Safety and Health.

Occupational Safety and Health Administration (OSHA) OSHA is an agency within the US Department of Labor. This agency, or administration, provides the regulation, guidance, and enforcement necessary to meet the requirements of the Occupational Safety and Health Act of 1970. The act provides for ensuring that every many and woman in the United States is provided a safe and healthful workplace. Training workers to be more aware of job safety and health hazards in the workplace helps to reduce the incidence of injury and disease. As Air Force Environmental Health Service personnel, you will be involved in this kind of training. OSHA standards are used to evaluate Air Force workplaces and to train Air Force civilian and military workers.

National Institute for Occupational Safety and Health (NIOSH). NIOSH is a part of the Centers for Disease Control, a subagency of the USDHHS. NIOSH provides training and publications in the area of safety and health in the workplace. NIOSH standards are used by the Air Force when evaluating working environments at base level industrial sites.

A discussion of agencies within the Federal Government which might provide assistance to an Air Force Environmental Health Service Worker could become endless. The idea behind sharing these few agencies and their roles with you is to let you know you are not alone with your important responsibilities. Whenever the need arises for you to seek aid from an agency outside the military structure, you need only look to your *Federal Government Registry* in any telephone book for help.

Exercise (002):

1. In column A you will find listed several functions performed by the environmental health office. In the space provided before each item, write in the letter that corresponds to the federal agency from column B which could provide guidance for that function. Each choice may be used once or more than once or not at all.

Column A

— (1) Egg inspection.
— (2) Health education for industrial workers.
— (3) Foodborne illness investigation.
— (4) Hearing conservation tests.
— (5) Food handler training.
— (6) Sanitary evaluation of food service facility.
— (7) Inspection of seafood and processing plants.
— (8) Requesting an air pollution study from BES.

Column B

a. Environmental Protection Agency.
b. Centers for Disease Control
c. United States Department of Agriculture.
d. United States Department of Commerce.
e. United States Public Health Services.
f. Occupational Safety and Health Administraton.
g. Food and Drug Administration.

1-3. Equipment and Supplies

You may at one time or another have seen in a newspaper or news magazine an article dealing with the amount of money spent by the Department of Defence (DOD). This yearly amount has been pictured by a circle representing one tax dollar. The largest single expenditure from the tax dollar is for the DOD, and thus the largest piece of pie from this circular dollar representative is marked "DOD."

Of this amount taken from each tax dollar for the DOD, some is used for supplies and equipment. It takes material to operate a business. It takes material to run an environmental health office. Look around your office. You might see an autoclave, refrigerator, desks, chairs, centrifuge, etc. All of these cost money and that money comes out of that piece of the pie the DOD carves out of each of our tax dollars.

It is the responsibility of each of us to order, use, and protect Government property judiciously, because we all paid for it. The section you are about to study deals with ordering, judiciously using, and protecting Government equipment and property.

003. Differentiate among th five categories of medical material.

Classification of Medical Material. Medical material may be termed either equipment or supplies. Equipment items are nonexpendable and must be authorized. Supplies are expendable and need no authorization. Material you should be familiar with is classified into one of the three equipment and two supply categories in the following descriptions.

Investment medical equipment. Investment medical equipment includes those items which have a unit cost of $3000 or more. An example of this is an audiometer.

Expense medical equipment. This is an item which has a unit cost of less than $3000; for example, one incubator will cost approximately $2500 and will be classified as expense medical equipment.

Nonmedical equipment. Nonmedical equipment includes nonmedical items with a unit cost of $40 or more. Some examples of nonmedical equipment are office desks, typewriters, and other office equipment.

Expendable medical supplies. Expendable medical supplies are either consumable or durable. A consumable supply item loses its identity when used, cannot be reused for the same purpose,or is not durable enough to last 1 year. Drugs, adhesive tape, detergent solutions, and scrub sponges are examples. A durable supply item which maintains its identity when used usually has a life expectancy of at least 1 year but does not qualify as an equipment item. Surgical instruments such as hemostats and scissors are examples of durable supplies.

Nonmedical supplies. Items which have a unit cost of less than $40 and are nonmedical in nature are termed nonmedical supplies. Examples are ballpoint pens, pencils, paper towels, writing and typing paper, and the one we are extremely well acquainted with — floor wax.

Exercises (003):

1. Match the material category in column B with the appropriate statement or term in column A by placing the letter of the column B item in the space provided in column A. Each column B item may be used once, more than once, or not at all.

Column A

— (1) A $2,300 centrifuge.
— (2) A bottle of detergent
— (3) A box of scrub sponges.
— (4) A box of paper clips.
— (5) An $80 office chair.
— (6) Loses its identity when used.
— (7) A pair of hemostats.

Column B

a. Investment medical equipment.
b. Expense medical equipment.
c. Nonmedical equipment.
d. Expendable medical supplies (consumable).
e. Expendable medical supplies (durable).
f. Nonmedical supplies.

004. Identify supply and equipment budgeting procedures.

Supply Budgeting. The resource management office in your medical facility is responsible for the preparation and submission of the annual budget for the entire medical facility. About 6 months prior to the start of a fiscal year, the reserve management office will request the environmental health office to supply fund requirements for supplies for that coming fiscal year. The first action you should take upon receiving this request is to study your previous year's supply expenditures. Your monthly issue lists from the medical supply section show a dollar value on the last page of each list. From these lists, determine how much you spent on supplies for the preceding fiscal year. These figures should assist you in approximating how much you will need for future supply expenditures based on previous expenditures.

There are other considerations you should keep in mind when estimating your future requirements. Note the inflationary trends of supplies over a period of time. Consider your workload for the foreseeable future — that is, an increase or decrease in base population.

Equipment Budgeting. Equipment budgeting, like supply budgeting, will be approximately 6 months prior to the coming fiscal year. Consider your needs by assessing your present equipment, its condition, and whether your mission can be met with what you now have in the office. Upon ascertaining your future equipment needs, you then must get an authorization for that item or items. It may be authorized in the table of allowances (TA 904), a special document showing items of equipment authorized for the accomplishment of your mission. Another means of authorization might be a written authorization from your command environmental health officer. Usually, the request for an item requiring special authorization must be approved by a local medical equipment review board. Submit the request for equipment of AF Form 601, Equipment Action Request.

When you are in the thoughtful planning portion of your equipment budgeting process, consider whether you can fully justify needs for replacement equipment items. Possibly, replacement may not be as economically feasible as repair of the existing equipment. The DOD is just like many of us in that it, like us, just squeaks by from payday to payday. Funds are limited. Your requests for new and replacement equipment will therefore be given very close scrutiny.

Exercises (004):

Identify each true statement and explain why the others are false.

____ 1. Fiscal year budgets are usually prepared about 6 months prior to the fiscal year.

____ 2. The resource management officer prepares and submits the annual budget for the entire medical facility.

____ 3. When you are preparing your budget estimates, consider only prior expenditures and new or replacement items of equipment.

____ 4. You may find authorization for equipment items in the TA 904.

____ 5. You should submit a request for an equipment item on AF Form 601.

005. Identify procedures for using indexes and supply catalogs.

Supply Catalogs and Indexes. You may well find yourself with the responsibility of ordering supplies and equipment for your office. It is therefore important that you have a basic knowledge of how to use indexes and supply catalogs. The supply catalogs, at first glance, may appear as being written and organized in a long since defunct format and language, but such is not the case. If they are complicated, it is only because there are so many items listed in the catalogs. The reason for the large number of listed items is that the DOD is a large business, and a large business takes a lot of equipment and supplies to operate.

The *Federal Supply Catalog* is arranged for the convenience of the user. It contains the complete identification and necessary stock control data (management data) for each item listed. Once you have located an item in the catalog, you need not refer to any other publication for official identification or management data.

The first four numbers of the national stock number — each item in the Government inventory has one of these numbers — indicates the Federal Supply Class Group. We will deal with the class group "6500," for this is the medical class group, the one you'll be most concerned with.

Introduction, 6500-IN. This portion of the catalog is located in the front and includes a table of contents of Federal Supply Class (FSC) Groups, an introduction, publication numbers, and much more. This is the portion that explains how to use the *Federal Supply Catalog*.

Identification list. This is the next section of the catalog, and it contains all the descriptive and reference data that officially identifies an item with its assigned national stock number. There are three major sections to this portion of the catalog:

(1) The alphabetical index, which is a "by name" index of all the items in that part of the catalog. If you know the name of an item, but not its national stock number, you'd use this section.

(2) The national stock number index, which lists all

the national stock numbers in numerical sequence. When you know the national stock number of an item, you'd use this part of the identification list to locate the item in the catalog.

(3) The item identification section, which is the portion of the catalog you'll head for after locating your required item in either of the other indexes we've just mentioned. Items are listed in this section by index (class) number, and each item is concisely described. By the time you get to this part of the identification list, you have the national stock number, the item name, and each item precisely described. If you've found what you needed, you're ready to contact medical supply with your order.

Exercises (005):

1. In the national stock number 6500-00-200-3025, which numbers indicate the Federal Supply Class Group?

2. What part of the *Federal Supply Catalog* contains a table of contents of Federal Supply Class Groups?

3. What is the name of the part of the *Federal Supply Catalog* that contains descriptive and reference data which officially identify an item with its assigned national stock number?

4. If you know the name of an item but don't know its national stock number, what part of the identification list must you use to locate the index number?

5. If you know the national stock number of an item but don't know its name, what part of the identification list must you go to in order to locate the index number?

006. Describe the two methods for ordering supplies.

Issue List. Regardless of which supply ordering method you use, an issue list will accompany each delivery. The issue list will also name any items that you previously ordered but are not yet available and so have been placed on "back order" for future delivery. If an issue list does not include these "back ordered" items, inform your medical supply section of the omission, for those items must appear on the issue list with the "back ordered" notation if you are subsequently to receive them.

Telephone Orders. Because of their speed and simplicity, telephone orders are the preferred method of ordering. The medical supply section provides you with a shopping guide which is a computerized listing of all expendable items you order on a recurring basis. The items on your shopping guide are listed in a stock number sequence, with each item having a line number. The medical supply section maintains a shopping guide card for each item listed on your shopping guide.

When it's time for you to order, you call medical supply and, using your shopping guide, place your order by line number. For example, you might say on the telephone "line 3, five boxes; line 5, two cans; and line 9, one case."

As you are talking, the medical supply clerk pulls that line item card and annotates the quantity for that line item. The clerk later prepares your order.

DD Form 1348-6, Non — NSN Requisition (Manual). If the item you want does not appear on your shopping guide, you must use this form to order it. This may entail going to the *Federal Supply Catalog* to obtain the item's name and national stock number as outlined in the previous section. Obviously, if you are the supply person in your office, it would be advantageous to get all the items your office needs on the shopping guide to preclude the catalog research in the future.

Exercise (006):

1. Briefly discuss the two methods for ordering supplies.

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CHAPTER 2

Basic Principles of Biology

UNTIL MODERN times, military medicine was primarily concerned with treating wounded soldiers so they could fire their muskets and remain an effective fighting force. Our basic military mission has not changed, but to operate high-performance aircraft and sophisticated missile systems, our airmen must be in top physical and mental condition. The basic mission of our Aerospace Medicine Program is to keep our people fit to fly and fight. Our primary emphasis must be to prevent disease and injury and to promote health.

As an environmental medicine specialist, you frequently will work with people who have been or may be exposed to various diseases or work hazards. Knowledge of the body and its functions will help you to understand what is wrong and how to help prevent the disease process. Appendix A, which describes medical terminology is listed at the back of this volume. You may need to refer to it frequently for this section (as well as other parts) of this volume.

2-1. Human Biology

A study of how to control communicable diseases must begin with an examination of "physiology" or how the normal human body functions. In the following section, we will look at the various physiological systems within the human body, how they function, and how these functions are of concern to Environmental Health Service.

007. State the functions and the Environmental Health Service concerns associated with the cell and cardiovascular system.

Cells. To start our study of human physiology we must look at the basic unit of life in the body, the cell. Each tissue and organ is actually a mixture of many different cells held together by intercellular supporting structures. There are approximately 100 trillion cells in the body.

Function. Each type of cell is specially adapted to perform one particular function that serves the body as a whole. For example, red blood cells transport gases to body tissue, nerve cells carry impulses, and white blood cells serve as part of the body's defense mechanism. Also, they must serve themselves by metabolizing nutrients in the presence of oxygen and making new products for the cell's existence. They must reproduce themselves for future generations.

The cell is made up of three basic parts; the cell wall, cytoplasm, and nucleus (fig. 2-1). The cell wall acts as a barrier and helps in the transportation of materials in and out of the cell. The cytoplasm is the work unit of the cell; the nucleus is the control center. Within each cell's nucleus are protein structures called chromosomes. The human cell has 23 pairs of chromosomes. The chromosome is important because attached to it are genes, which determine the code of life.

Genes. The genes of the chromosomes not only control heredity from parents to children, but the daily functions of the cells. The gene, which is a nucleic acid called deoxyribonucleic acid (DNA), is the coded model for the formation of another nucleic acid, ribonucleic acid (RNA), which spreads through the cells and controls the formation of different structures. The majority of these are proteins or enzymes that regulate the different chemical reactions that take place in the cells.

Scientists estimate that there are well over a million genes in a nucleus of the human cell. These duplicate prior to cell reproduction, one set going to each daughter cell.

Environmental Health Service concerns. Ionizing radiation causes damage to the cell. First, this radiation reacts with the water molecules in the cells to create hydroxides which are very toxic to cell life. The second type of damage involves damage to the DNA, RNA, and protein. Ionizing radiation can cause the double helixed DNA molecule to be knotted. When this happens the cell can't divide properly. This type of radiation may also cause a piece of the DNA to be broken off, causing incomplete information to be passed on during division. Lastly, ionizing radiation exposure may alter the DNA, changing the information coded there and causing mutations to occur. When changes to the information coded on the DNA occur it is called a mutagenic effect. The cells that are most rapidly reproducing are the type that are affected most by exposure to ionizing radiation. These are blood, intestinal, reproductive, and cancer.

Cardiovascular System. The cardiovascular system performs as a pickup and delivery system for the body.

Function. Blood picks up nutrients and gasses from the digestive system and respiratory system and delivers them to the cells. From the cells it picks up waste products and delivers them to the excretory organs and respiratory system.

Anatomy. In order for us to explain how the cardiovascular system serves as a "pickup and delivery system" we need to take a detailed look at the anatomy of this system; i.e., we need to look at the blood (its composition), the blood vessels, and the heart.

Blood. Blood is more than a simple liquid. It consists of plasma and billions of blood cells. Each type of blood cell has a specific function. Additionally, the blood plasma has a very important role in serving the body. The blood plasma is the liquid portion of the blood

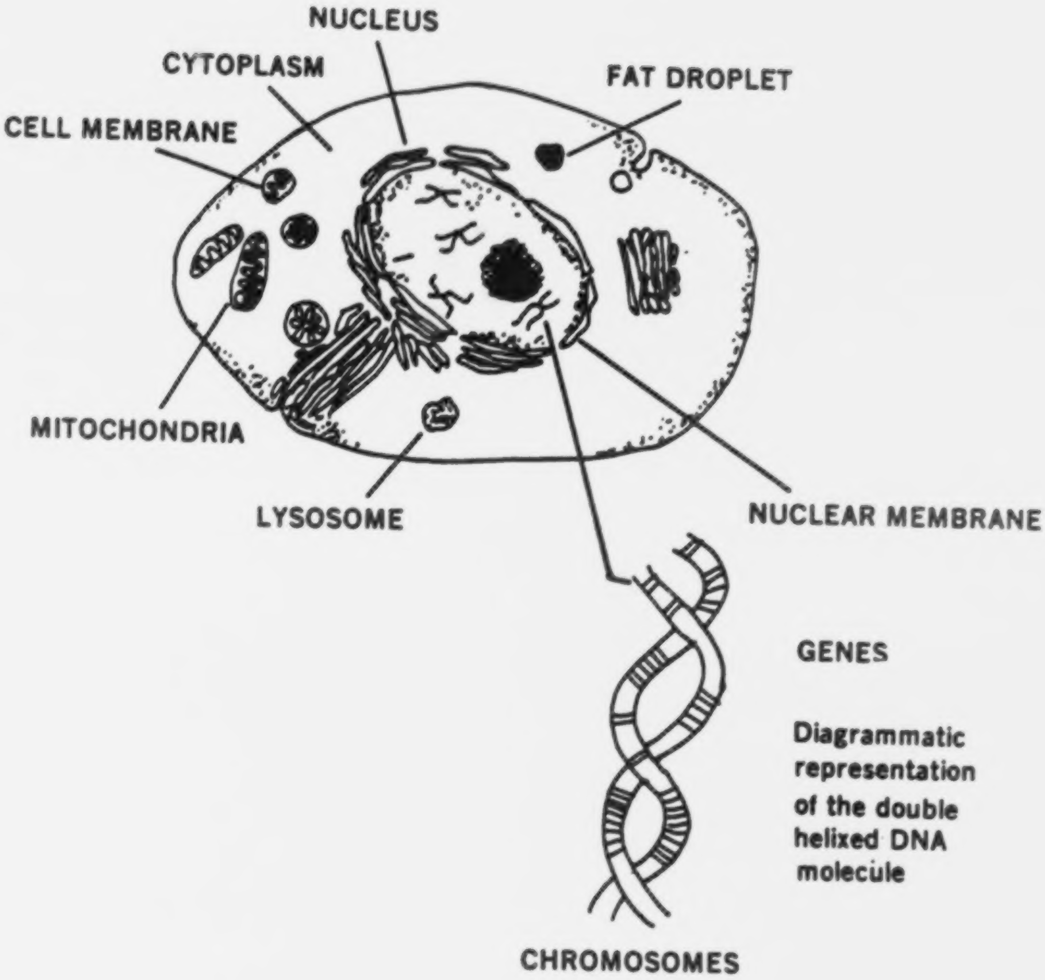

Figure 2-1. Cell structure.

minus the cells. It is clear to straw colored and serves to transport nutrients, hormones, proteins, and wastes.

The *erythrocytes*, or the red blood cells (RBC's), contain hemoglobin, which functions to transport oxygen to the cell and carbon dioxide away from the cell. However, this hemoglobin, has a greater affinity for carbon monoxide than for oxygen. This means that in the presence of both, it will more readily pick up carbon monoxide and transport it to the cell, leaving the body tissues to starve for oxygen. Also, ionizing radiation causes the greatest damage to those cells which are most rapidly reproducing. The red blood cells are in this group.

The *leukocytes*, or white blood cells (WBC's), are part of the body's defense mechanism and attack invading substances. The body knows when a foreign material (antigen) is present and alerts the WBC's and the reticuloendothelial system to seek out and attack the foreign invader. One type of white blood cell, the lymphocyte, plays a major role in the development of immunity by forming antibodies. The antigen's presence stimulates lymphocytes to produce specific antibodies. The antibody then reacts with the antigen to prevent harmful effects. Ionizing radiation, heavy metals, and certain types of solvents can damage the blood forming organs, interfering with white blood cell reproduction.

The *thrombocytes*, or *platelets*, are sack-like objects which are not really true cells. These sacks break when they impact with anything and help the blood to start to clot (e.g., cut or bruise).

Blood vessels. The blood vessels of the body fall into three principal classes. One is the distribution system, which is made up of arteries and their smaller branches, the arterioles. Another is a system of minute vessels, the capillaries, through which substances are exchanged between blood and tissues. Finally, there is a collecting system, made up of venules and veins, which returns the blood to the heart.

The arteries are elastic tubes, constructed to withstand high pressure, which carry blood from the heart. They give off branches of various sizes, which, in turn, divide and subdivide into smaller and smaller vessels. The terminal branches are called arterioles. The muscular wall of the arteries is under the control of nerves which cause the muscle to relax or contract to increase or decrease the diameter of the vessels. In this way, blood pressure is regulated.

At the ends of the arterioles is a system of minute vessels called capillaries. They have very thin walls and interact with each other to form a dense, interlacing network in all parts of the body. As the blood passes through the capillaries, it gives oxygen and nutritive substances to the tissues and takes up various waste products to be carried away by the veins. In the respiratory and digestive systems, this process is reversed so oxygen and nutrients may be picked up.

The veins comprise a system of vessels that collect the blood from the capillaries and carry it back to the heart. Their structure is similar to that of the arteries except that their walls are thinner with less muscle tissue. Veins begin as tiny venules, which are formed from capillaries — joining together much as tiny streams connect to form a river. The force of muscles contracting adjacent to veins aid in the forward propulsion of blood on its return trip to the heart. Valves, spaced frequently along the larger veins, prevent backflow.

Heart. The blood vessels are a distribution system for the blood, but without the heart the blood could not be transferred throughout the body. The cardiac muscle, or myocardium, provides the propulsive force. The interior of the heart is divided into a right and left portion by a dividing wall. In each half there is a upper chamber, the atrium, which receives blood from the veins. The lower chamber, the ventricle, receives blood from the atrium and pumps it out into the arteries. The openings between the chambers on each side of the heart are supplied with one-way valves which prevent backward flow of the blood.

Physiologically, the heart acts as two separate pumps. The right side receives deoxygenated blood into the right atrium from the various regions of the body. From the right atrium, deoxygenated blood passes through a valve into the right ventricle. Then the right ventricle pumps the blood through the pulmonary valve, into the pulmonary arteries, and on to the lungs. The transport of blood in the pulmonary artery is the only case where an artery normally carries deoxgenated blood. In the lungs, through the process of external respiration, blood exchanges carbon dioxide from the body tissues for a fresh supply of oxygen. This phase is called the pulmonary circulation. Systemic circulation occurs next, from the lungs, oxygenated blood travels through the pulmonary veins into the left atrium, and through valves into the left ventricle. The left ventricle pumps the oxygenated blood through a valve into the aorta, and on into all regions of the body by way of the arterial network, figure 2-2.

Environmental Health Service concerns. Ionizing radiation destroys blood forming organs. Another EHS concern of the cardiovascular system is carbon monoxide (CO). Hemoglobin in the blood has a greater affinity for carbon monoxide than for oxygen or carbon dioxide. In other words, in the presence of both CO and oxygen the hemoglobin will bond first with the CO, leaving the body tissues to starve for oxygen. Eventually the heart will be affected as it requires oxygen for energy to pump.

Exercises (007):

1. What effect does ionizing radiation have on the cell?

2. What is the function of the genes?

3. What is the function of the cardiovascular system?

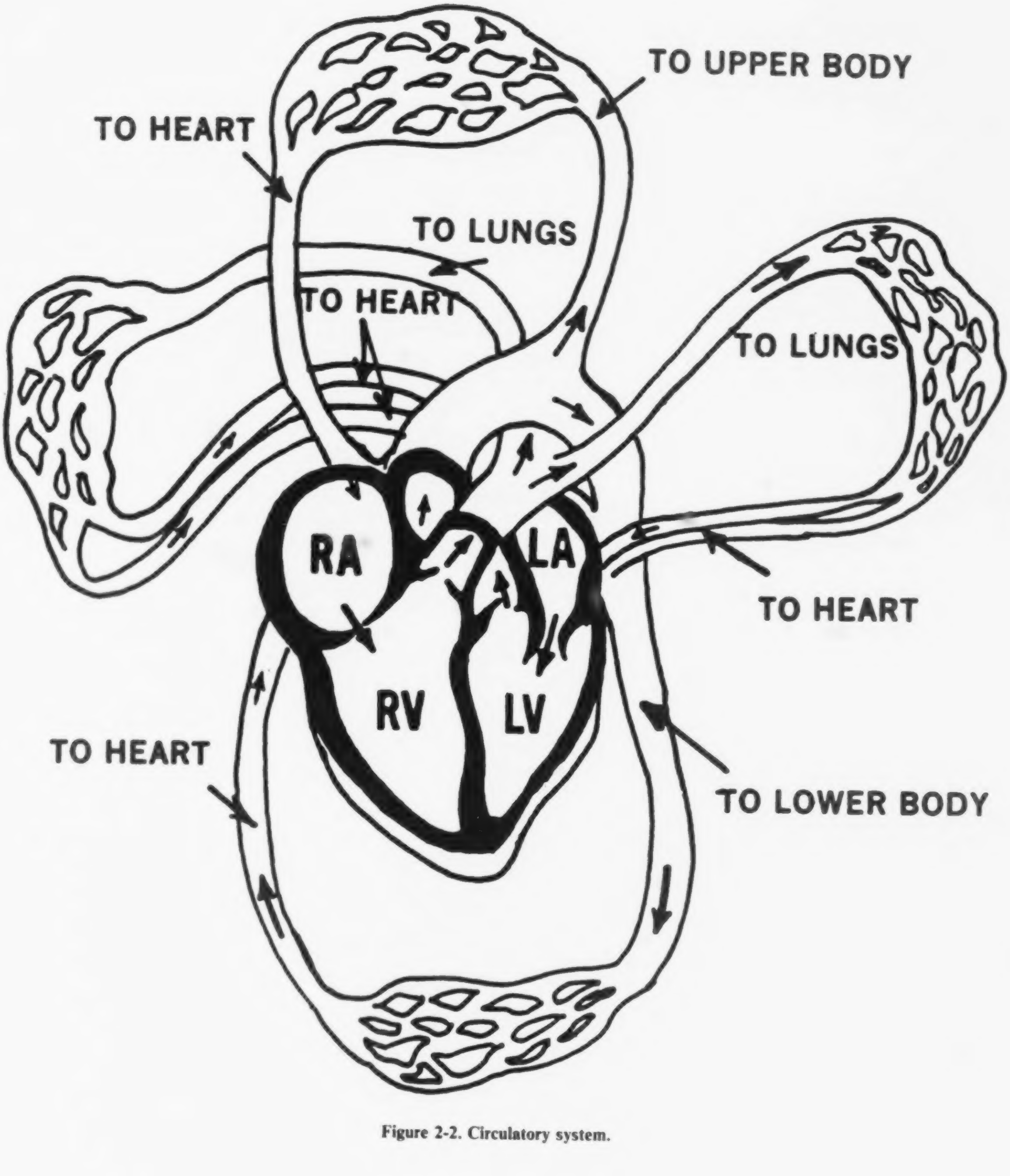

Figure 2-2. Circulatory system.

4. Carbon monoxide has what effect on the cardiovascular system?

5. Why are the lymphocytes so important?

6. What role do platelets serve?

7. Where does oxygen exchange occur in the cardiovascular system?

8. Describe pulmonary circulation.

008. Cite the functions and the Environmental Health Service concerns associated with the respiratory system.

Respiratory System. All human life on earth is based upon our ability to use oxygen and get rid of carbon dioxide. Humans can survive for a short time without food or water but only for a few minutes without air.

Functions. The major function of the respiratory system is to provide a means by which oxygen can enter the blood and reach every cell. In this way foods may be oxidized by the cells, thereby supplying energy to carry on the cell's life sustaining activities. Many cells, notably those of the central nervous system and heart, are extremely sensitive to low blood levels of oxygen, or hypoxia, and of course to complete lack of oxygen, anoxia. Without oxygen, most brain cells are dead within 3 to 5 minutes. Oxygen reaches the cells, and carbon dioxide is eliminated from these cells, by a process called cellular respiration. Clinically, breathing and respiration are usually understood to be synonymous, but this is not always a true interpretation. There really are two major types of respiration. Cellular respiration is concerned with the release of energy from foodstuffs within the cells. The other type of respiration involves breathing. We are concerned with the breathing kind of respiration in this text.

Breathing as respiration can be further subdivided into external respiration, during which oxygen leaves the atmosphere and enters the blood stream, while carbon dioxide leaves the blood and enters the atmosphere; and internal respiration, which involves the exchange of oxygen and carbon dioxide between the blood and the cells.

Anatomy. All portions of the respiratory system (fig. 2-3) except its microscopic sized sacs called alveoli function as air distributors. Only the alveoli serve as gas exchangers. The major organs involved in the respiratory system are the nose, pharynx, larynx, trachea, bronchi, and lungs.

Nose. The nose consists of two passageways lined with ciliated mucous membrane and separated by a partition made of cartilage and bone. Ciliated mucous membrane is found in most of the airways of the respiratory system, even the bronchioles. In addition to serving as an airway, the nose also warms and moistens incoming air, and its cilia and mucous membranes trap dust and other foreign matter. The nasal mucosa contains the receptors for the sense of smell, and the nasal cavities contribute to the quality of the voice. About 1 quart of mucus is produced by the nasal mucosa each day, partly as a protective mechanism and partly as a reaction to dust, pollen, and other materials. Mucus is either eliminated by blowing the nose, or it is swallowed.

Pharynx. The pharynx (or "throat") is the tube-like structure that begins just posterior to the nasal cavities and ends at the esophagus. It connects the nose and mouth with the remainder of the respiratory and digestive tracts, and is important in the formation of vowels during phonation. The pharyngeal walls are muscular, and are lined with mucous membrane. Three pairs of lymphoid organs associated with the pharynx are called tonsils (pharyngeal, palatine, lingual). The tonsils may serve as filters of harmful microorganisms, but chronic infection or inflammation may necessitate their removal.

Trachea. The trachea or windpipe extends from the larynx to the level of the fifth thoracic vertebra, where it divides into two primary bronchi, one for each lung. The trachea consists of smooth muscle, reinforced with C-shaped rings of cartilage, incomplete posteriorly. The gap at the back of the trachea is bridged by a connective tissue membrane. The esophagus lies directly posterior to the trachea, and as a mass of food passes down the esophagus on its way to the stomach, it causes the membrane of the trachea to bulge inwardly. The right and left primary bronchi branch into secondary bronchi as they enter the lungs, which in turn branch into smaller and smaller bronchi, all with rings of cartilage. Finally, the very smallest bronchi give rise to microscopic branches called bronchioles, which are made essentially of smooth muscle without cartilage. The bronchioles end in millions upon millions of microscopic blind or "deadend" air sacs, the alveoli. Like the pulmonary tree of bronchi and bronchioles, the circulatory tree of pulmonary blood vessels is very extensive. Each alveolus is surrounded by capillaries, and it is here that the exchange of oxygen and carbon dioxide takes place. Cilia line the walls of the trachea and bronchi, and they beat or wave constantly in one direction only — upward toward the larynx. Normal everyday quantities of mucus and trapped dust particles are moved upward by the cilia, and coughed into the mouth. Breathing consists of two phrases — inspiration, during which air is taken into the lungs, and expiration, during which air leaves the lungs and returns to the atmosphere.

How we breathe. The diaphragm is the chief muscle that helps us breath. It acts as a suction plunger on inspiration and as a compressing piston on expiration,

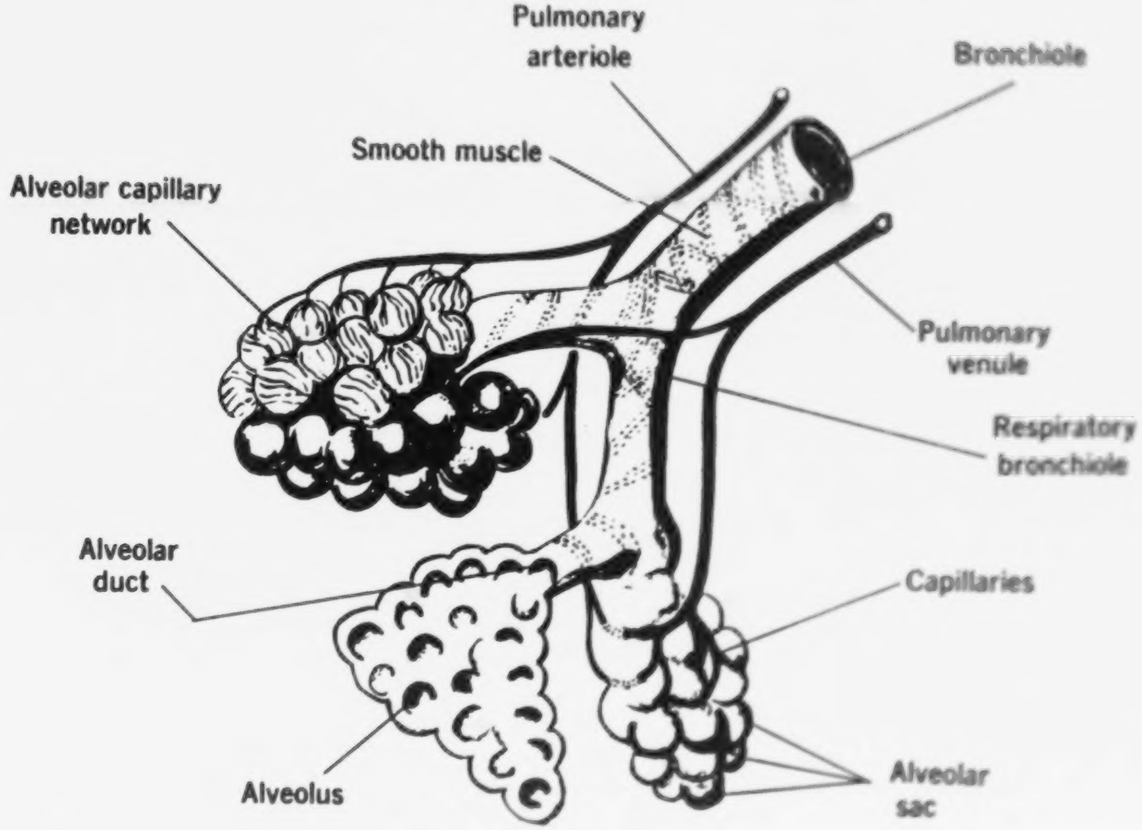

Figure 2-3. The structure of the alveoli and the capillary network around them.

and in the individual at rest being almost solely responsible for the intake and expulsion of air by the lungs. Other muscles, especially upon exertion, also assist in the breathing process. Notable among these are the external intercostal muscles, which help to elevate the ribs and expand the chest during inspiration, and the internal intercostals which contract to help compress the chest during expiration. During vigorous exercise, even the large pectoralis major muscles help to expand the chest to its largest capacity so that as much air as possible may enter the lungs.

This continuing process of inspiration and expiration is primarily involuntary and continues even though a person is asleep or unconscious. There is a degree of conscious control over breathing, however. For example, it is possible for a person to hold his breath, and it is also possible for the conscious will to control the rate and depth of breathing. This control is from a higher voluntary center of the brain in the cerebral cortex. Impulses from these higher centers reach the involuntary respiratory center over specific nerve pathways and temporarily override its automatic function. Nerve impulses from it, then, are in accordance with the desires of the high center. This control by the higher center is limited by chemical changes in the blood which occur, and the control then reverts back to the involuntary center. The controlling factor is not the oxygen requirement, as you might think, but the carbon dioxide level in the blood. In exercise, for example, increased oxygen is used and increased carbon dioxide is produced. The increase in carbon dioxide is the factor which causes a person to begin breathing faster and deeper. This increased rate of breathing results in more oxygen being brought into the body to meet the new oxygen requirements. Under such circumstances, the respiratory center responds by stimulating the nerves controlling respiratory movements; the respiratory rate is increased; and the body rids itself of the excess carbon dioxide.

Environmental Health Service concerns. The respiratory system is one of the major modes of entry of illnesses and toxic substances. Some of the diseases you will be involved in investigating and controlling are tuberculosis, beta strep, and influenza. Unprotected exposures to toxic substances can cause what is termed "occupational illnesses." Pneumoconiosis is a general term meaning "dust retained in the lungs." The inhalation of dust containing crystalline free silica (from grinding or sand blasting operations) may result in an occupational illness called silicosis. In silicosis the lymph nodes in the lungs trap particles and become enlarged, eventually causing obstruction in bronchioles and resulting in a loss of vital capacity. Asbestosis is caused by an inhalation of asbestos fibers (from asbestos insulation removal or installation). With asbestosis, the fibers become lodged in the bronchioles where they cause irritation, eventually causing an obstruction. Exposure to major air pollutants, such as an air pollution episode, also can have an effect on the respiratory system, particularly within susceptible populations, such as the very young and very old. In many of the major air pollution episodes that have occurred, lesions on the lungs were found in those who died from the pollution.

Exercises (008):

1. Specify the function of the respiratory system.

2. Compare external and internal respiration.

3. Classify the portions of the respiratory tract as air distributors or gas exchangers.

4. State how inspiration and expiration occurs.

5. What is the function of the other respiration muscles (intercostal muscles and the large pectoralis major muscles)?

6. What is the controlling factor for the continuing process of inspiration and expiration?

7. Specify the EHS concerns of the respiratory system.

8. How is silicosis caused?

009. State the functions and the Environmental Health Service concerns associated with the urinary and reproductive system.

Urinary System. If humans are to live they must take food, water, and oxygen into the body. It is equally vital that the human body gets rid of waste which would otherwise cause its death.

Function. It is the elimination of these wastes, chiefly by our urinary system, that we are interested with at this time. The urinary system is also important in the homeostasis of fluids, electrolytes, and acids and bases. The urinary system is the primary filtering system of the body. It consists of two kidneys, two ureters, a urinary bladder and a urethra. The kidneys perform the filtering function and excrete waste products through the ureters. The composition of the blood is not so much determined by what is eaten by the mouth, but by what the kidneys keep. The ureters are long, slender, membranous tubes that carry urine from the kidneys to the urinary bladder. The bladder acts as a reservoir for the urine until it is emptied through the urethra. The urethra is a narrow tube leading from the urinary bladder to the outside of the body.

Urine formation. Each kidney is supplied by an artery and a vein called the renal artery and renal vein. The renal artery branches directly off the abdominal aorta, and the renal vein empties directly into the inferior vena cava. The blood is filtered as it flows through the microscopic parts of each nephron unit shown in figure 2-4. Waste products of metabolism are removed. The proper pH (acid-base balance) and concentration of water and salts are maintained in the body by reabsorption into the blood before it passes into the renal vein. The extra water and waste products flow into the kidney, pelvis, and the ureter.

This end product of kidney filtration and reabsorption is called urine. Normally, it is amber-colored, free of bacteria, and contains about 95 percent water. Various organic and inorganic compounds make up the remaining 5 percent. A normal adult excretes about 1500 ml of urine a day. However, this amount is influenced by body temperature, fluid intake, and water loss through perspiration. A large water intake does not necessarily put a strain on the kideys. On the contrary, it provides the conditions that keep urine from being so highly concentrated with waste products. There is less strain on the entire urinary system when this concentration is low.

Environmental Health Service concerns. Certain toxic substances filtered out of the blood by the kidney can cause damage to the kidney if stored or concentrated. Some examples of substances which cause renal damage are most of the heavy metals (inorganic lead, mercury, chromium, uranium, cadmium, and arsenic), some of the halogenated hydrocarbons (carbon tetrachloride, trichlorethylene, and trichlorethane), and some of the aromatic hydrocarbons (benzene and toluene). Although the herbicide paraquat produces profound pulmonary damage following acute intoxication, in sublethal doses paraquat appears to be actively se-

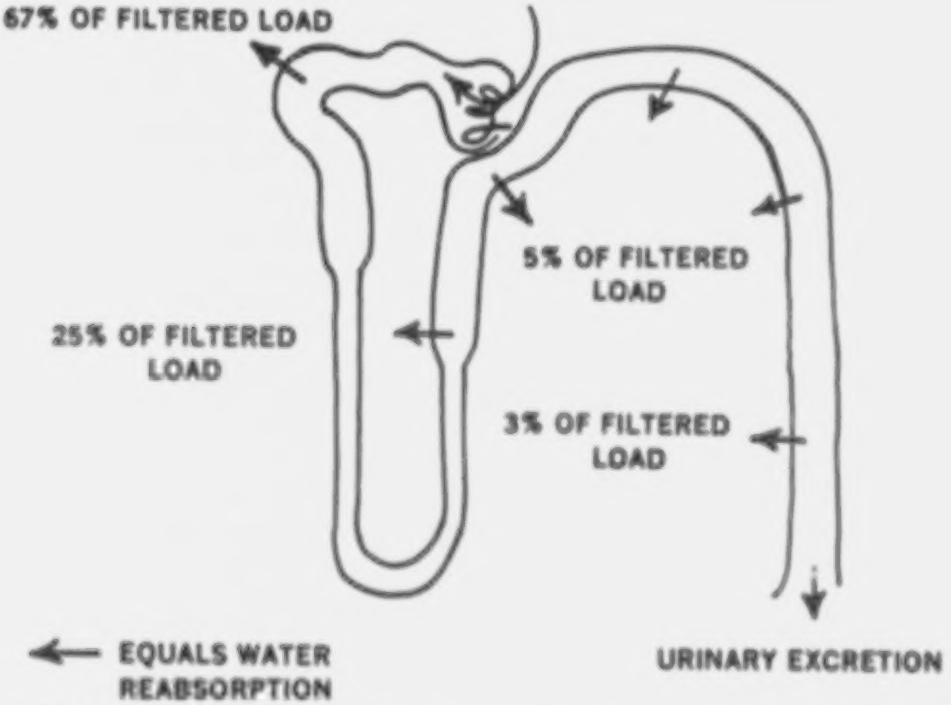

Figure 2-4. This diagram of the nephron unit in the kidney demonstrates how urine becomes concentrated. Over 90 percent of the water entering the nephron is reabsorped into the body. There are approximately a million nephron units in each kidney.

creted by the kidney and is fairly rapidly removed from the body. It produces direct renal damage, thereby reducing its own elimination.

Reproductive System. A brief explanation of human reproduction, without detail, is a fairly simple one. The male, by means of his copulatory organ, the penis, injects his sex cells, sperm, into the vagina, which is the copulatoryorgan of the female. If pregnancy is to take place, one of these sperm cells must unite with a female sex cell, or ovum (egg cell). If this happens, fertilization has occurred, and the newly fertilized egg, or zygote, will grow and develop into an embryo and then a fetus before birth takes place approximately 9 months later. To fully understand the EHS concerns of the reproductive system a more complete understanding of both male and female reproductive systems is in order. It is to the anatomy and physiology of these systems that we now turn our attention.

The male reproductive system. The male organs of reproduction consist externally of the penis and scrotum. Internally, the system is made up of several glands and the ducts that connect these glands to the urethra.

The primary function of the male reproductive system is spermatogenesis (the production of sperm) and hormone production. The sperm is produced in the testes and then temporarily stored in the epididymis. When copulation takes place sperm pass up the vas deferens into the urethra and pass out through the penis. Along this route the seminal vesicles, prostate and bulbourethral glands, pour seminal fluids into the tubes.

The female reproductive system. The female reproductive system includes the ovaries, fallopian tubes, uterus, vagina, and external genitalia.

The primary function of the female reproductive system is oogenesis (the production of eggs) and hormone production. The eggs are expelled from ovaries into the abdominal cavity, and then picked up by the oviducts. If the eggs are not fertilized within 8 to 24 hours, they will die. If fertilized, the embryo develops. Gametogenesis refers to the production of both egg and sperm.

Environmental Health Service concerns. As previously discussed, ionizing radiation exposure can cause damage to the DNA in the cell, resulting in genetic mutations (called mutagenic effect). Also, this type of radiation can cause a teratogenic effect; i.e, resulting in damage to the unborn child.

Toxoplasmosis (a disease caused by a protozoan parasite) and syphillis contracted during pregnancy may produce fetal malformations by direct invasion and destruction of fetal tissue. Methyl mercury ingestion by pregnant women may produce cerebral palsy in offspring, even though the mothers were symptom free. Rubella infection during pregnancy may produce cataracts and other eye abnormalities, deafness, cardiac defects, and mental retardation. Dioxin, a potent mutagen, teratogen, and and carcinogen (cancer-causing) is a contaminant of the herbicide 2,4,5, T widely used in agriculture and as a defoliant for military purposes. We mentioned syphillis as a disease which could cause damage to the fetus, but that is not the only effect it may have. It, as well as many of the other sexually transmitted diseases (these will be discussed in detail in

Chapter 6), can cause sterility, impotence, and scarring of the tissues in the reproductive system.

Exercises (009):

1. Cite the function of the urinary system.

2. How is the blood filtered?

3. How does water intake affect the kidney operation?

4. What are the EHS concerns with the kidney?

5. What is spermatogenesis?

6. What is oogenesis?

7. What is meant by gametogenesis?

8. What effects does ionizing radiation have on the reproductive system and what are the effects called?

9. Toxoplasmosis and syphillis have what effect on an unborn child?

10. What are some other effects of sexually transmitted diseases?

010. State the functions and Environmental Health Service concerns associated with the digestive, reticuloendothelial, and nervous systems.

Digestive System. The digestive system prepares food for absorption and for use by millions of body cells.

Function. Food must be altered chemically as well as physically before it can be used by the body. It doesn't remain for long in the mouth; it is quickly swallowed (often without thorough chewing) and passes through the pharynx and down the esophagus or food tube to the stomach, where it is temporarily stored. In this organ, more enzymes and hydrochloric acid are added to the food and a certain amount of mechanical mixing and massage takes place due to the reflex contraction of smooth-muscle fibers in the stomach wall. After a variable length of time, the partially digested food leaves the stomach and enters the first 10 inches of the small intestine, the duodenum. Here, secretions of the liver and pancreas are added, along with a secretion of the duodenum itself. The duodenum is continuous with the next portion of the small intestine, the jejunum, which in turn is continuous with the next portion, the ileum. Intestinal juice is added as food moves through all portions of the small intestine, and most digestion and absorption takes place within this portion of the digestive tract. After the small intestine has coiled for over 20 feet in the abdomen, the distal end of the ileum joins the first first portion of the large intestine, or colon. All unabsorbed food passes into the large intestine as waste, and although absorption of large quantities of water and small amounts of other substances occurs in this portion of the digestive tract, the colon serves largely as an organ of egestion by eliminating solid wastes from the body (fig.2-5).

Environmental Health Service concerns. Certain foods may become vehicles for bacteria or viruses causing foodborne illnesses such as staphylococcal and streptococcal food poisonings. The intake of toxic chemicals (as well as bacteria and viruses) may cause a poisoning resulting in gastritis (inflammation of the stomach), gastroenteritis (inflammation of the stomach and the bowel), and enteritis (inflammation of the bowel). Cholera affects mainly the large intestine and causes dehydration because the large intestine excretes too much fluid. This disease commonly causes death in underdeveloped countries where proper medical treatment and water disinfection is not available or is not sufficient. Intestinal parasites such as tapeworms, pinworms, and flukes are commonly transmitted among school-age children.

Reticuloendothelial System. This system is part of the body's defense mechanism. The reticuloendothelial system consists of specialized cells that perform phagocytosis (fig. 2-6 shows an engulfing of microorganisms, other cells, and foreign particles by phagocytes). There are two types of phagocytes, the macrophages and the reticuloendothelial cells. Some of the macrophages are fixed while others are mobile and in the presence of infectious agents, the free macrophages become activated, attack, and engulf the agents. The reticuloendothelial cells are mainly fixed and are located in major organs, bone marrow and the lymph system. Even though these defense cells are in a stationary location, they are still capable of attacking and engulfing an antigen that may wander in their direction.

Nervous System. The nervous system controls our every thought and action. No matter what our daily activities may be, we are completely dependent upon this complex system. The two specialties of nervous tissue are responsiveness and conductivity, the ability to convey or transmit electrical-type nerve impulses from one part of the body to another.

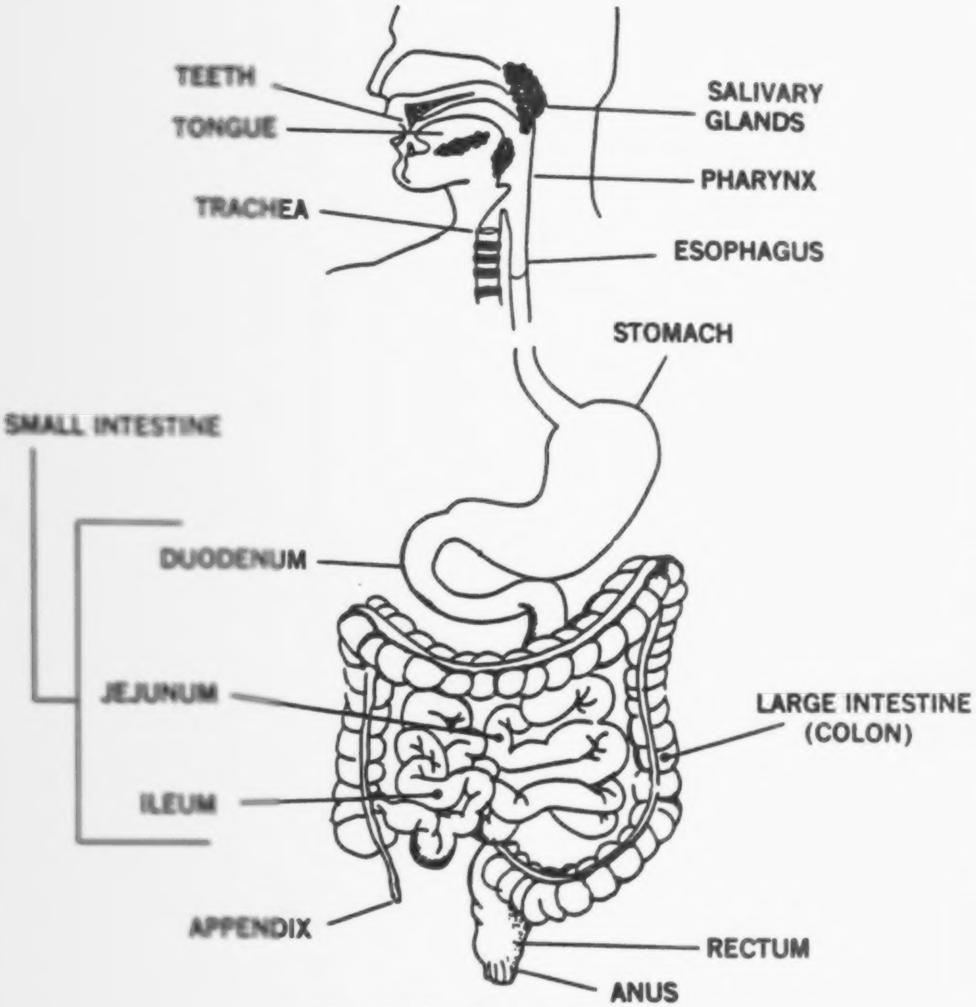

Figure 2-5. The digestive system.

PHAGOCYTOSIS. The cell gradually engulfs the solid particle such as a bacterial cell. If a water droplet is engulfed, the process is called "pinocytosis."

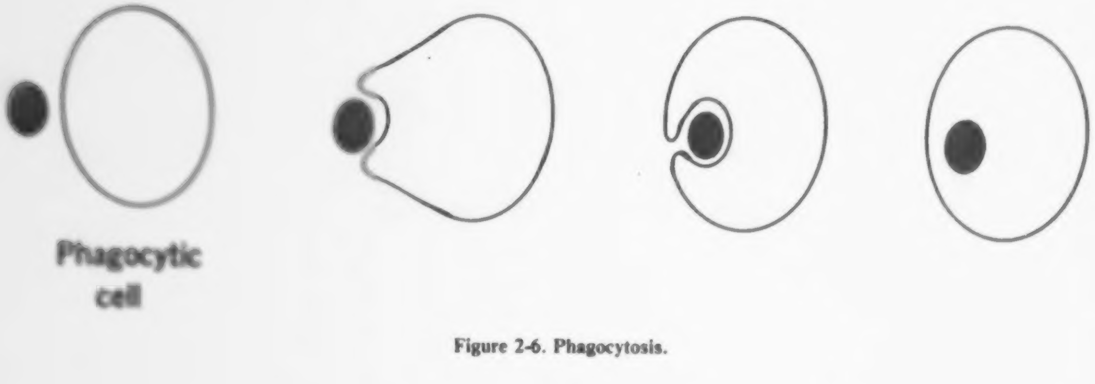

Figure 2-6. Phagocytosis.

Function. The nervous system functions to keep us informed about changes in our internal and external environment, helping us to make appropriate adjustments to these changes when necessary. Many of these adjustments are carried out reflexively, completely below the level of consciousness. For example, the nervous system largely controls the regulation of body temperature, heart rate, and urine formation. However, the body processes are not always regulated by this system alone. The endocrine system produces hormones that aid in this regulation, but the nervous system plays the chief role.

The nerve cell or neuron is the most important structure of the nervous system. Neurons have a cell body and two types of extensions or processes — axons and dendrites. Impluses flow toward the cell body over the dendrites and away from the neuron cell body over axons. The cell body of a neuron is necessary to the survival of the entire neuron. It is here within the cell body that the vital processes of neuron metabolism take place. Separation of the cell body from axon or dendrites would cause the death of those processes even though the cell body itself would survive. The cell bodies of certain neurons in the brain are capable of sending out impulses without prior stimulation.

Supporting cells. Neurons are the functional units of the nervous system, but they constitute only one kind of structural unit found in nervous tissue. Special cells, called neuroglia, help to give nervous tissue support. There are three major types of neuroglia; astrocytes, oligodendrogli and the microglia. In addition to helping support nervous tissue, microglia may also act as phagocytes, engulfing cellular debris and potentially harmful bacteria and other microorganisms.

The nerve impulse. As we said before, there are two basic types of cells — neuroglia (support) and neurons (carry messages). Sensory neurons carry messages to the brain and motor neurons carry messages from the brain. The structure of the cell consists of the soma (body of the cell), dendrite (carries stimuli to soma), axon (continues message from soma to another cell), and the synapse (the junction where axon gives message to the dendrite). Refer to figure 2-7. Still, how do these messages travel? The stimulus received at the synapse causes the release of a chemical mediator, acetycholine, from the end of the axon. The acetycholine crosses the synapse and finds a receptor on the dendrite. The presence of the acetycholine in the receptor causes the stimulus to be carried on. Acetycholine is removed by an enzyme, cholinesterase and the stimulus stops. This mediator-receptor fit must be correct, like a key and a lock fit. Malfunctions can occur in several ways. There may be no mediator to release. This situation is not very common because only minute quantities are needed and the chemical mediator (acetycholine) substance is recycled. Another malfunction may result from there being no enzyme to remove the mediator. The continued presence of the mediator in the receptor causes excess stimulation resulting in fatigue. Finally, a foreign substance may occupy the receptor site preventing the mediator from getting to it. The last is a commonly used system in medicine to benefit mankind.

Environmental Health Service concerns. Many body functions operate by this receptor and mediator method. In the nervous system certain toxic substances can interfere with its proper operation. The two major groupings of these toxics are central nervous system (CNS) depressants and CNS stimulants.

CNS depressants. CNS depressants depress the autonomic nervous system (smooth muscles, cardiac muscles — i.e., the vital organs). Some of the best examples of CNS depressants are the organic solvents such as trichloroethylene that act as a narcotic or an anesthetic.

CNS stimulants. CNS stimulants stimulate acetylcholine production which stimulates the smooth muscle (lungs, heart). Cholinesterase immediately neutralizes the effects of acetylcholine. Nerve agents and the organophosphate pesticides inhibit cholinesterase and the nerve continues to stimulate the muscles. Eventually paralysis or death may occur. Examples of CNS stimulants include phenols and some organophosphate pesticides (malathion, parathion, etc.).

Exercises (010):

1. State the function of the digestive system.

2. What happens in the stomach to aid in the digestion process?

3. Where (in the digestive system) does most of the digestion and absorption of food occur?

4. What is the function of the large intestine?

5. What is gastritis, gastroenteritis, and enteritis? Cite some possible causes of these conditions.

6. Cholera affects, mainly, which portion of the digestive system? What does it cause?

7. What is the function of the reticuloendothelial system?

8. In your own words, what role does the nervous system play?

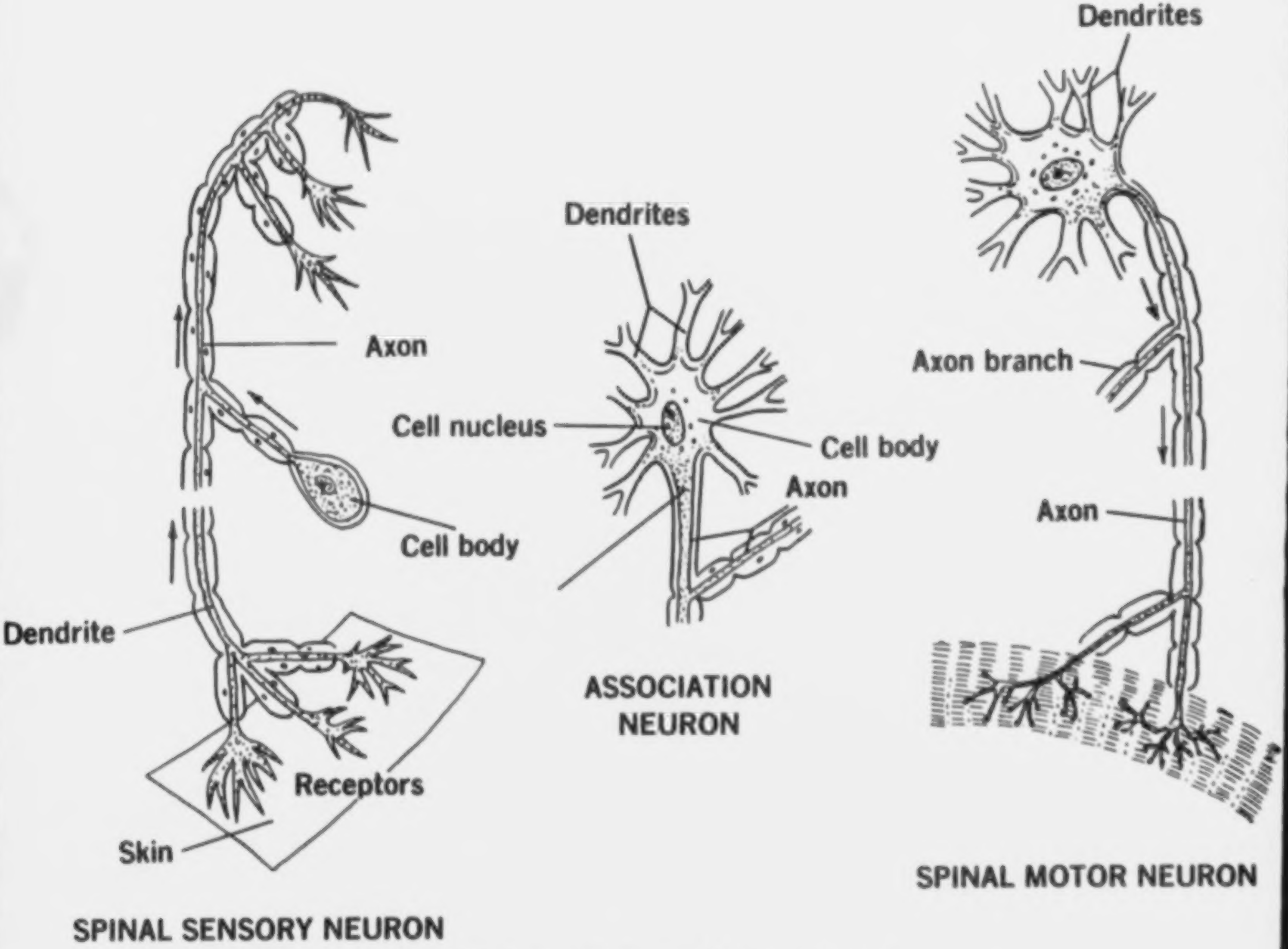

Figure 2-7. Three types of neurons and their microscopic structure.

9. Explain how messages within the nervous system travel.

10. What is the effect on the nervous system of CNS depressants (and give an example of a CNS depressant)?

11. What are some examples of CNS stimulants: What effect do they have?

011. State the function and the Environmental Health Service concerns associated with the auditory system and the eyes.

Auditory System. Hearing, one of our five senses, helps to keep us aware of changes in our environment.

Anatomy. The ear, the organ of hearing, is divided into three parts — the external ear, the middle ear, and the inner ear. These parts are shown in figure 2-8.

External ear. The external ear consists of a flap or modified trumpet called the auricle and the ear canal. The auricle picks up or collects the sound waves (like a catcher's mitt) and directs them through the ear canal to the eardrum or tympanic membrane. The ear canal is approximately 1 inch long and contains many ceruminous glands that constantly secrete cerumen or "earwax." The wax keeps the ear canal moist and helps to trap dust and foreign particles which might otherwise enter the ear.

Middle ear. The middle ear is contained within a cavity of the temporal bone. The cavity is lined with mucous membrane and contains the tympanic membrane, the eustacian tube, and three tiny ear bones called ossicles.

The tympanic membrane stretches across the ear canal and separates the external ear from the middle ear. It receives sound vibrations from the external ear and transmits them to the ear ossicles. It also protects the middle ear from outside dirt, water, and foreign objects. This tympanic membrane is important in diagnosing diseases of the middle ear. It is a tough membrane but can be perforated by either infectious processes or injury.

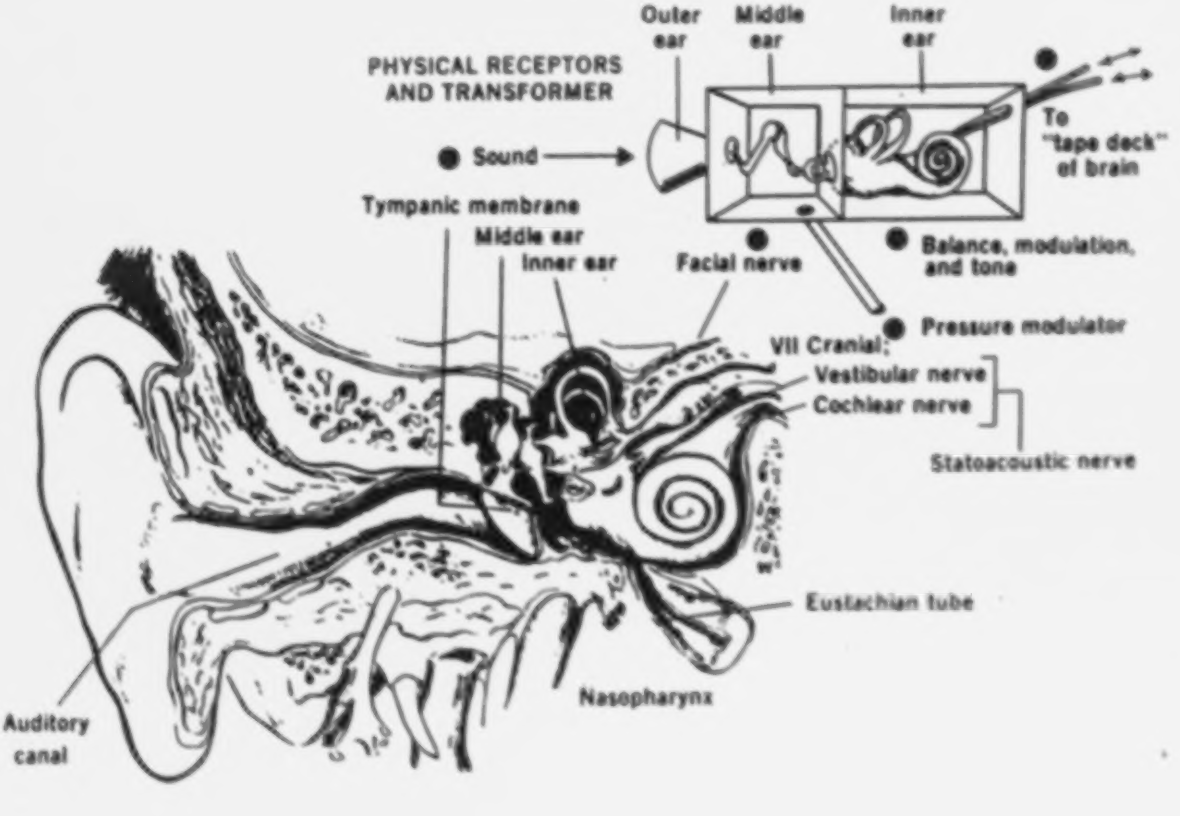

Figure 2-8. The human ear and the auditory apparatus.

The eustacian tube connects the middle ear cavity with the pharynx. Its function is to equalize the air pressure in the ear with that of the atmosphere. This pressure adjustment is especially important during air flight and under water. Unless the pressure is equalized, the eardrum might burst.

The ossicles, or the ear bones, are the smallest in the body. Together they transmit vibrations from the tympanic membrane to the inner ear. They reach across the middle ear or ear cavity in the form of a chain. The first bone is the malleus and is attached directly to the eardrum. It is shaped somewhat like a miniature hammer. The second bone, the incus, is attached to the malleus and is shaped like an anvil. The third and innermost bone is the stapes and is shaped like a small stirrup. It is attached directly to the inner ear.

The Inner ear. The inner ear, or labyrinth, contains the innermost part of the ear. It consists of a series of complicated canals located in a hollow portion of the temporal bone. It contains the receptors for both hearing and equilibrium. The receptor for hearing is the organ of Corti, contained inside a fluid-filled, shell-like structure called the cochlea. Vibrations reach this structure from the external ear by way of the three tiny ear bones. Their vibrations cause movement of the fluid within the cochlea which stimulates the sensory nerve endings in the organ of Corti. From the organ of Corti the nerve impulses are relayed by the acoustic nerve (Nerve VIII) to the hearing center in the temporal lobe of the brain.

Environmental Health Service concerns. The sensory nerve endings found in the cochlea are sound frequency specific. When the unprotected ear is exposed to sufficient volume of sound for a length of time (if the sound is loud enough it doesn't take very long) it causes the sensory nerve endings to lose their ability to sense sound. This loss of sound perception may be only temporary (i.e., a temporary threshold shift, temporary hearing loss) or permanent (permanent threshold shift, permanent hearing loss). The effect noise has on hearing and how we can protect our hearing and the hearing of others will be discussed in a later section.

The Eyes. In the eyes we have special sensory dendrites that allow us to perceive different colors and shapes (i.e., allows us to see).

Anatomy. The eye is the organ of sight. Accessory structures such as the ocular muscles, eyelids, conjunctiva, and lacrimal apparatus assist it in its function. The eye is a hollow ball or glove containing various structures to perform specific functions. The eyeball, itself, is composed of three layers of tissue (fig. 2-9).

The outer layer. The outer layer of the eye is called the sclera. The sclera is the white, protective covering of the eyeball. The sclera surrounds the eyeball entirely except for a small segment covered by the cornea. The cornea is a small area of the anterior sclera which has been modified. The sclera is resistant to stretching and tearing and provides strength to the fluid-filled eyeball. If this outer layer is cut or penetrated, it is possible for the fluid content of the eye to leak out. You can compare this leak to letting the air out of a tire. Very soon, a tire with a hole in it will collapse. So will the eye.

Middle layer. The middle layer of the eye consists of the choroid, the iris, and ciliary body. The choroid is a highly vascular layer that supplies the eye with nutrition and lines the posterior portion of the eye. The iris is a thin, circular-shaped membrane that gives the eye its color. It resembles the shutter of a camera and surrounds the pupil, which is the opening through which light rays pass. The dilation and contration of the pupil caused by the iris regulates the amount of light reaching the retina. The ciliary body suspends the iris and lens and contains the ciliary muscles which make movement of the lens possible. The lens is a transparent body just behind the pupil. The function of the lens is to focus light upon the retina. The lens automatically changes its shape to accommodate for near or distant vision. It assures that the image of what we see is focused on the retina. Occasionally, the lens loses its transparency, a condition called a cataract.

Inner layer. The innermost layer of the eye is the retina, a delicate membrane upon which images are received. It is a complex network of nerve cells and fibers called rods and cones. These rods and cones are light receptors distributed throughout the retina except for the very center which contains only cones. There is a greater concentration of rods in the outside edges of the retina. When light enters the eye and strikes the rods and cones, nervous impulses are created which travel through nerve fibers in the retina toward the optic disc. This disc is a short distance medial to the macula, that area in the center of the retina which contains only cones.

Optic fluids. Refer to figure 2-9 and see that the eye contains two regions divided by the lens. One cavity is located in front of the lens and is called the anterior chamber. The other chamber, located behind the lens and in front of the retina is called the posterior chamber. The anterior chamber contains a clear, watery solution called aqueous humor, which helps to reflect light rays and bathe the lens. In the posterior chamber a gelatin-like fluid called the vitreous humor helps to reflect light and maintain normal pressure within the eyes.

Optic muscles. The eyes are attached to the orbits by means of ligaments, muscles, nerves, and blood vessels. Six muscles are attached to each eye. Normally, these muscles are finely balanced and coordinated so that they automatically move both eyes in the same direction at the same time. Sometimes, however, one or more of them may become paralyzed or weak.

Accessory structures. The accessory structures of the eye include the eyebrows, the eyelid, and the lacrimal apparatus. Each structure has a distinct and specialized function. The eyebrows, with their thick fold of skin and short hairs, serve as protective structures for the eyes. The eyelids are folds of connective tissue which protect the eye from foreign material and excessive light. They also spread the lacrimal secretions over the surface of the eye. The lacrimal apparatus is concerned with the release of tears. The function of the tears is to lubricate and clean the conjunctiva.

How we see. When an object is viewed, the lens sys-

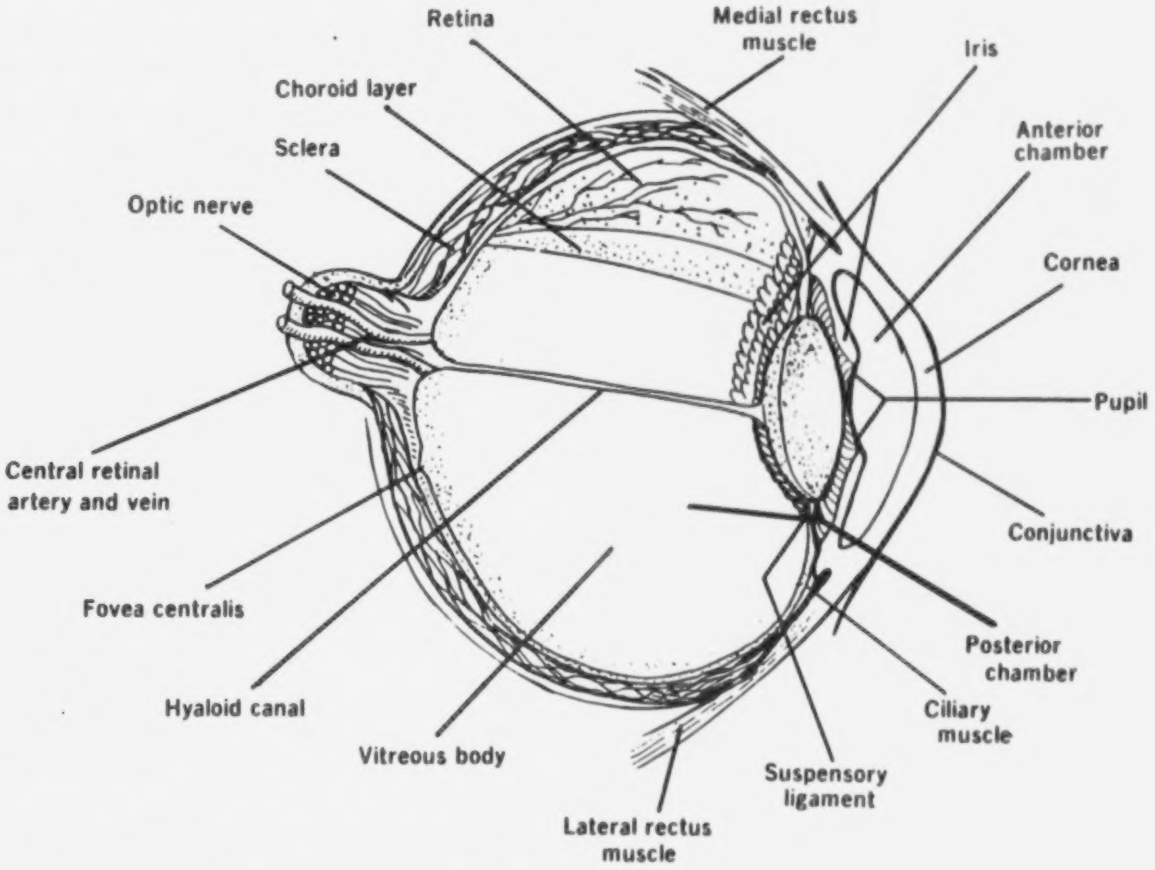

Figure 2-9. The eye.

tem of the eye projects an image on the retina containing the rods and cones. When light falls on these nerve endings, impulses are generated and relayed to the brain through the optic nerve where they are integrated and interpreted as visual images.

All parts of the retina do not react to light in the same way. The macula lutea, also called the macula, is a small central area on the retina containing numerous cones. It is responsible for visual acuity and for color discrimination. The fovea, in the direct center of the macula, is the "bull's eye" for our line of sight. Central vision, also called direct vision, is performed by the macula lutea.

The remaining or peripheral area contains rods mostly, with only a few scattered cones. It is capable of less acute visual reception and of poor color determination, but it functions under very low illumination. This "corner of your eye vision" is the vision that is most attracted by a movement into the field of vision. It gives us our peripheral vision which is useful in both daylight and night light.

Environmental Health Service concerns. Nonionizing radiation (radar, microwave) exposure to the unprotected eye can cause cataracts if the radiation level is intense enough. Remember, since the lens of the eyes have very few blood vessels it is not able to adequately dissipate the heat caused by this type of radiation (hence the "cooking" of the lens would occur similar to what happens when an egg white is cooked). Ultraviolet radiation (such as is produced by arc welding) causes "sunburned" eyeballs. In this case the ultraviolet radiation creates a photochemical reaction in the very outside layer of the eye which kills the cells there, hence the "sunburned" effect. Lasers can cause annoying glare and mild bleaching of the photoreceptors (similar to seeing "spots" when looking at a very bright light) up to massive, permanent damage to the retina.

Exercises (011):

1. Name the three parts of the ear.

2. What is the function of the tympanic membrane?

3. Describe the importance of the eustachian tube.

4. Where are the receptors for hearing and equilibrium located?

5. State the environmental health concerns of the auditory system.

6. What is the opening in the eye through which light passes?

7. Describe the function of the lens.

8. Describe how we see.

9. What are some of the EHS concerns with the eyes?

012. State the functions and Environmental Health Service concerns associated with the liver and skin.

Liver. The largest internal organ in the body is the liver. Situated in the right upper quadrant of the abdomen just below the diaphragm it performs the life sustaining task of filtering blood through and between large, star-shaped macrophages called Kupffer cells. The Kupffer cells are phagocytic reticuloendothelial cells that are important in the body's defense against infection. They help to cleanse the blood by ingesting certain microorganisms and foreign matter from it as it flows into the liver.

Functions. For a long time it was believed that the "yellow bile" produced by the liver was necessary for good health. Today, we recognize the importance of bile as well as some of the other important things the liver does for the body. Some of its major functions are:

(1) Aids in the metabolism of carbohydrates, proteins, and fats.

(2) Makes and secretes bile. Bile emulsifies fat, an essential process before fats can be digested.

(3) Helps maintain the proper level of sugar in the blood by changing glucoses into glycogen, storing it, then changing it back to glucose when it is needed.

(4) Makes plasma proteins and antibodies.

(5) Stores vitamins A and D, and some minerals.

(6) Produces heparin and fibrinogen which influence clotting of blood.

(7) Destroys worn out red blood cells.

(8) Detoxifies substances which might be harmful, such as the end products of protein digestion, alcohol, and anesthetics.

(9) Produces heat.

Environmental Health Service concern. Hepatitis (inflammation of the liver) may be induced by solvents or other chemicals, bacteria, and viruses. Toxin accumulation is another EHS concern with the liver. As a storage organ, the liver collects many substances which can't be excreted. After a period of time, liver damage from another source may result in a "release" of the toxic substances and result in an acute toxicity to the body.

Skin. The integument, or skin as it is commonly called, protects the body from invasion by bacteria and other harmful microorganisms, helps maintain a constant body temperature, prevents water loss, excretes wastes, receives four kinds of sensations, produces a vitamin, and absorbs certain drugs and other chemical substances. It has a remarkable ability to heal itself. In order to carry out all these functions, the skin must be tough and pliable, selectively permeable, and well supplied with nerves and sensory receptors, blood vessels, and glands. The sweat and sebaceous glands, the hair, and nails are all derivatives of the skin.

Anatomy of the skin. The skin is made up of two major layers, an innermost dermis and an outermost epidermis (upon or on the dermis). These are further divided into several smaller layers, as illustrated in figure 2-10. These smaller layers are indistinct in some regions of the skin, but are easily seen in a cross-sectional microscope slide of the thick skin of the back or of the soles of the feet.

Epidermis. There are several layers of the epidermis. Actually it is a combination of five layers of cells. Although these layers resemble dry, clear, overlapping scales, they develop part of the accessory skin organs. In addition, their overlapping arrangement prevents the passage of almost every known variety of disease germ. The cells in the first two layers are dead or dying, while those in the two deeper layers are alive and constantly dividing. The cells of the outermost layer have no nuclei, and contain the hornlike protein material, keratin. They are constantly worn away and shed, but are replaced by cells from another layer. The three upper layers of the epidermis could not exist without the lower layers. There the cells multiply and slough off when they reach the outer layers. Figure 2-10 shows how the epithelial cells of the skin are arranged into layers and the relationship of the skin to its accessory organs, which are sweat glands, sebaceous glands, and hair.

Dermis. The inner of the two main layers of epithelial cells is the dermis. It is also known as true skin. Within the dermis are located capillaries, nerve endings, and skin pigment. Capillaries nourish these cells, which multiply rapidly and push toward the epidermis. Because of this constant activity, minor injuries to the dermis are quickly repaired without leaving a scar. The nerve endings respond to pressure, pain, and changes

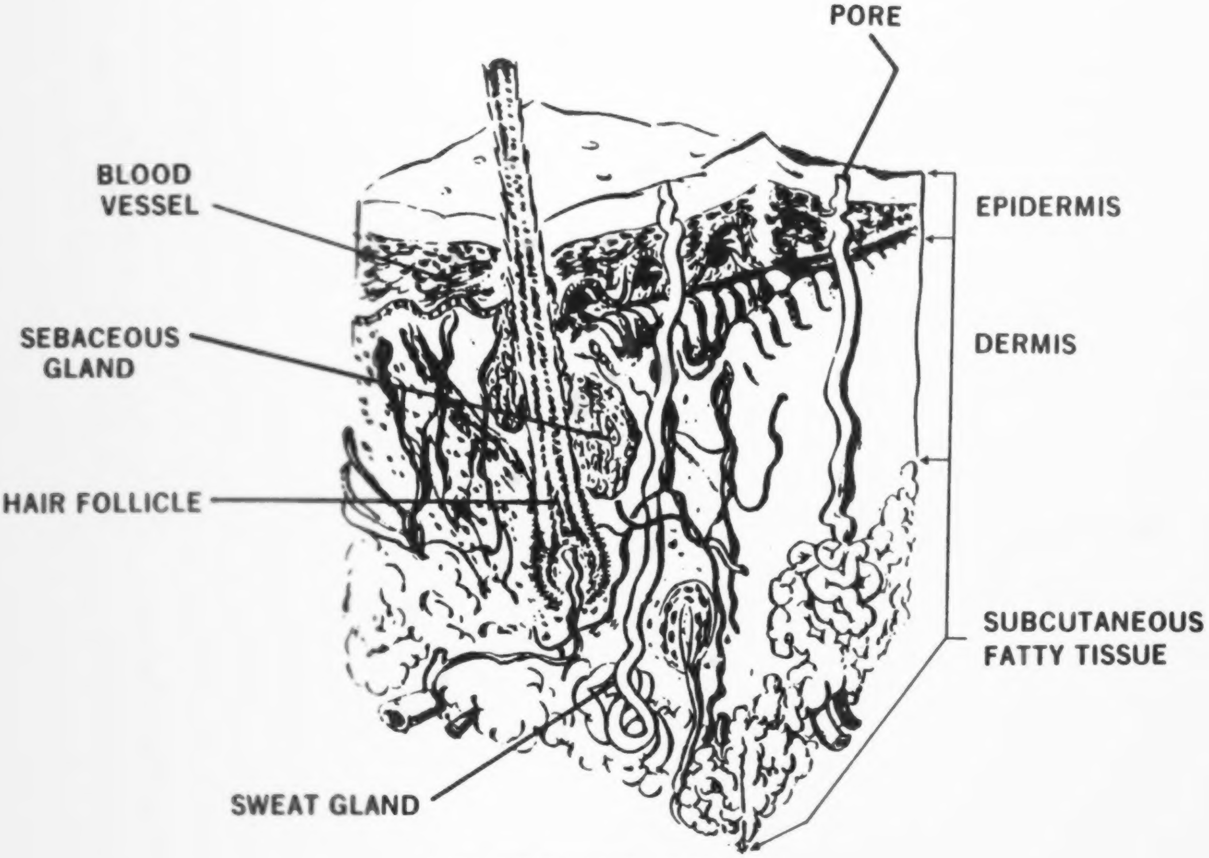

Figure 2-10. Cross section of the skin.

in temperature. Pigment cells give the skin its color.

Accessory skin organs. You must realize that epithelial cells are not all arranged in flat, smooth layers, but may be located in pockets within the subcutaneous fatty tissue. It is such pockets that the accessory skin organs develop.

Sebaceous glands are located about the hair shaft. These glands secrete an oily substance, sebum, which keeps the skin soft and pliable.

Sweat glands are tubular organs imbedded in the dermis. The prespiration or sweat they excrete is carried to the skin surface through ducts and out through skin openings called pores.

Hair is composed of modified epithelial cells. The hair root is imbedded in the fatty subcutaneous tissue and is nourished by dermal capillaries. The hair shaft rises up through the hair follicle, the tube in which it grows. Alongside each hair follicle is a special tissue called arrector muscle. Since the hair grows in a slight angle, whenever the dermal nerve endings are stimulated by cold, or other special stimuli, the arrector muscle is also stimulated. This stimulation forces the hair to straighten, giving the skin the appearance of "goose flesh."

Function. From the discussion of the skin structure, you may have determined that there are three main functions for which the skin is responsible.

Protection. As stated previously, the overlapping arrangement of the epidermal and dermal cells prevents the passage of almost every known variety of disease germs. Dermal cells reassure protection by their ability to replace injured or diseased tissue. Further protection to the body is accomplished when the skin acts as an organ or sensation. The nerve endings in the dermis perceive heat, cold, pressure, and pain. Once the nerves react to these stimuli, the nervous and muscular systems use reflex action to prevent serious injury.

Temperature regulation. Not only does the skin detect heat and cold, it helps regulate body temperature. According to which stimulus they receive, capillaries within the dermis dilate to allow warm blood to come near the skin surface to lose its heat. On the other hand, capillaries may constrict, which decreases the amount of blood at the skin surface and conserves heat within the body. The skin also secretes perspiration from the sweat glands as the body temperature rises. Perspiration escapes from the pores, evaporates on the skin surface, and produces a cooling effect.

Excretion. Perspiration contains salts, acids, urea, and carbon dioxide. Its evaporation on the skin surface is a means of excreting these wastes products from the body. An average of a quart daily many be excreted, but the amount varies considerably, depending upon the temperature, humidity, and amount of physical activity performed by the individual. Perspiration is continuous, but it may be so slow and it may evaporate so quickly that it goes unnoticed.

Environmental Health Service concerns. The majority of accidents or incidents that occur in the industrial areas involve the skin in one form or another. Contact dermatitis (inflammation of the skin caused by exposure to chemicals, ultraviolet radiation, heat, etc.) is a commonly occurring occupational disease you will see at your base. Why is this such a prevalent condition? Part of the answer to this question is obvious. The skin, as a mode of entry, is the largest area exposed to toxic chemicals and infectious agents. The rest of the answer involves the use (or maybe we should say nonuse) of protective equipment, controlling the toxins in the workplace, and health education of the industrial worker, supervisor, and our own medical staff as to the importance of recognizing and preventing the exposure. Each of these areas will be discussed in detail in later sections of your career development course.

In conclusion, the human being is truly a very complex organism. To quote Hamlet — "What a piece of work is man! How noble in reason! How infinite in faculty! In form and moving how express and admirable! In action how like an angel! In apprehension how like a god! The beauty of the world! The paragon of animals!"

Exercises (012):

1. Cite the functions of the liver.

2. Cite some possible causes of hepatitis.

3. How does the skin protect the body?

4. Name the two major layers of the skin.

5. Where are the capillaries, nerve endings, and skin pigment located?

6. How does the body regulate temperature?

7. State EHS concerns of the skin.

013. Identify functions and EHS concerns of organs or organ systems.

After reviewing objectives 001 through 012, answer the following matching exercises.

Exercises (013):

1. Match functions in column A with the appropriate organ or organ system in column B.

Column A

___ (1) Plays a major role in the body's defense against microorganisms after they have invaded the body.
___ (2) Regulates fluid balance and cleanses blood.
___ (3) Changes sound waves into recognizable nerve impulses.
___ (4) Detoxification of substances and stores certain key vitamins and minerals.
___ (5) Provides body with a rapid means of communication.
___ (6) Provides protection against entry of excess sunlight and most chemicals.
___ (7) Composed of air distributors and gas exchangers; allows oxygen to reach cells in the body.

Column B

a. Cardiovascular system.
b. Nervous system.
c. Ears.
d. Liver.
e. Skin.
f. Kidney.
g. Respiratory system.

2. Match each physiological system in column A with the primary EHS concern in column B. Some column B items may be used more than once.

Column A

___ (1) Cardiovascular system.
___ (2) Urinary system.
___ (3) Respiratory system.
___ (4) Reproductive system.
___ (5) Digestive system.
___ (6) Nervous system.
___ (7) Eyes.
___ (8) Liver.
___ (9) Skin.
___ (10) Ears.

Column B

a. Carbon monoxide.
b. Dermatitis producing agents.
c. Tuberculosis.
d. Silicosis.
e. Cholera.
f. Organophosphate pesticides.
g. Sexually transmitted diseases.
h. Permanent threshold shifts.
i. Ultraviolet radiation.
j. Chemical hepatitis.
k. Heavy Metals.

2-2. Principles of Microbiology

Microbiology may be defined by analyzing the root words from which it is formed — *micro* means "too small to be seen with the naked eye" and *biology* is "the study of living things". Thus the definition of microbiology is "the study of living things too small to be seen with the naked eye." Some people might say, "So what! Why do I need to worry about something I can't see?" We in the Environmental Health Service very well realize what these "little things" that we can't see do for us as well as to us. But do we know how and why? Are we able to identify basic principles of microbiology to practically apply them to our daily duties in food/facility inspection and the control of communicable diseases?

There is no need for this text to try to teach you all that is known about microbiology because there are hundreds of thousands of microorganisms that will be of no concern to you as an environmental health specialist. There are, however, certain "microbes" that you will be directly associated with, and it is these microorganisms with which we will concern ourselves.

014. Associate terms used to describe cell structure with appropriate descriptive phrases.

Cell Structure. To appreciate the basic principles of microbiology you first must recognize the importance of the living cell, the basic unit of all living things. Whether an organism is microscopic or macroscopic, the smallest living unit of an organism is the cell. The smallest microorganisms are composed of only one cell, and, of course, the largest of the plants and animals are made up of many millions of cells.

In terms of structure, there is no such thing as a typical cell; cells come in many shapes and sizes. It is not necessary, for our purpose, to discuss the anatomy of each of the many kinds of cells, nor is it necessary to go into the complete anatomy of cells. However, we will look at a few important structures that will enable us to better understand how cells functions.

Protoplasm. Protoplasm is the living substance that makes up cells. This word isn't very specific because living material is composed of a wide variety of intricately organized substances. Protoplasm may best be regarded as a complex mixture of protein molecules, fat globules, inorganic salts, sugars, and amino acids in water.

Cell membrane. The cell membrane is a structure through which materials pass into and out of the cell. This membrane, like a strainer, is selective; that is, it will allow some materials to pass through, but will not allow the passage of others. The cell membrane is therefore said to be semipermeable. Plant cells have a rigid outermost layer called a cell wall. This structure, composed primarily of cellulose, gives the plant cell its rigidity.

Nucleus. The nucleus is usually the most obvious anatomical feature of a cell, standing out as a rounded body slightly denser than the surrounding cytoplasm. (Cytoplasm is the protoplasm outside the nucleus.) The nucleus contains chromatin, a complex material that is ultimately responsible for controlling all activity of the cell.

Mitochondria. Mitochondria are sometimes referred to as the powerhouses of the cell. These oval-shaped structures, found throughout the cytoplasm, have been shown to be the site of the greatest amount of metabolic activity within the cell. They break certain organic compounds down into carbon dioxide and water, releasing energy in the process.

Vacuoles. Membrane-enclosed, fluid-filled spaces called vacuoles are found in many types of cells. There are various kinds of vacuoles with a corresponding variety of functions. One example is the food storage vacuole. Another type, found in some one-celled organisms, is responsible for expelling excess water from the cell.

After you work the exercise on the basic cell structure, we will discuss specific microorganisms in more detail.

Exercise (014):

1. Match the items in column B with the most appropriate description in column A by writing the correct letter in the blank provided.

Column A

___ (1) Semipermeable.
___ (2) Rounded body slightly denser than surrounding cytoplasm.
___ (3) Complex mixture of protein molecules
___ (4) Oval-shaped structure; powerhouse of the cell.
___ (5) Membrane-enclosed, fluid-filled.
___ (6) Material that controls all activity of the cell.

Column B

a. Protoplasm.
b. Mitrochondria.
c. Cell membrane.
d. Nucleus.
e. Chromatin.
f. Vacuoles.

015. Describe bacteria and identify the shapes of the different types of bacterial cells.

Bacteria. Bacteria are tiny, single-celled organisms that resemble plants in that they have a rigid cell wall. Bacteria are unlike plants in that they have neither chlorophyl, nor organized, well-defined nuclei. Since they lack chlorophyl, and subsequently lack photosynthetic activity, they must absorb food from their environment. The chromatic, though not organized into a definite nucleus, does function much the same as chromatin in other cells.

Figure 2-11 shows that bacterial cells occur in a number of shapes: round, called cocci; oval (or elongated into rods), called bacilli; and a third group of bacteria that are shaped like little coil springs, called spirochetes or spirilla. The shape of a particular bacterium is one of the main criteria used in its identification. Another major factor in identification is the way the cells are arranged or grouped together. An arrangement grouped in clusters like grapes is called staphylo. Therefore, round bacteria (cocci) that appear in clusters are called staphylococci. Some cocci arrange themselves into pairs. Paired organisms are called diplo, thus the term "diplococci." Still another group of cocci forms into long chains. These organisms are known as streptococci. The bacillus organisms, or rod-shaped bacteria, may align themselves into chains or pairs, and these are occasionally called streptobacilli or diplobacilli. The spirochetes vary from a loose spiral to a tightly coiled

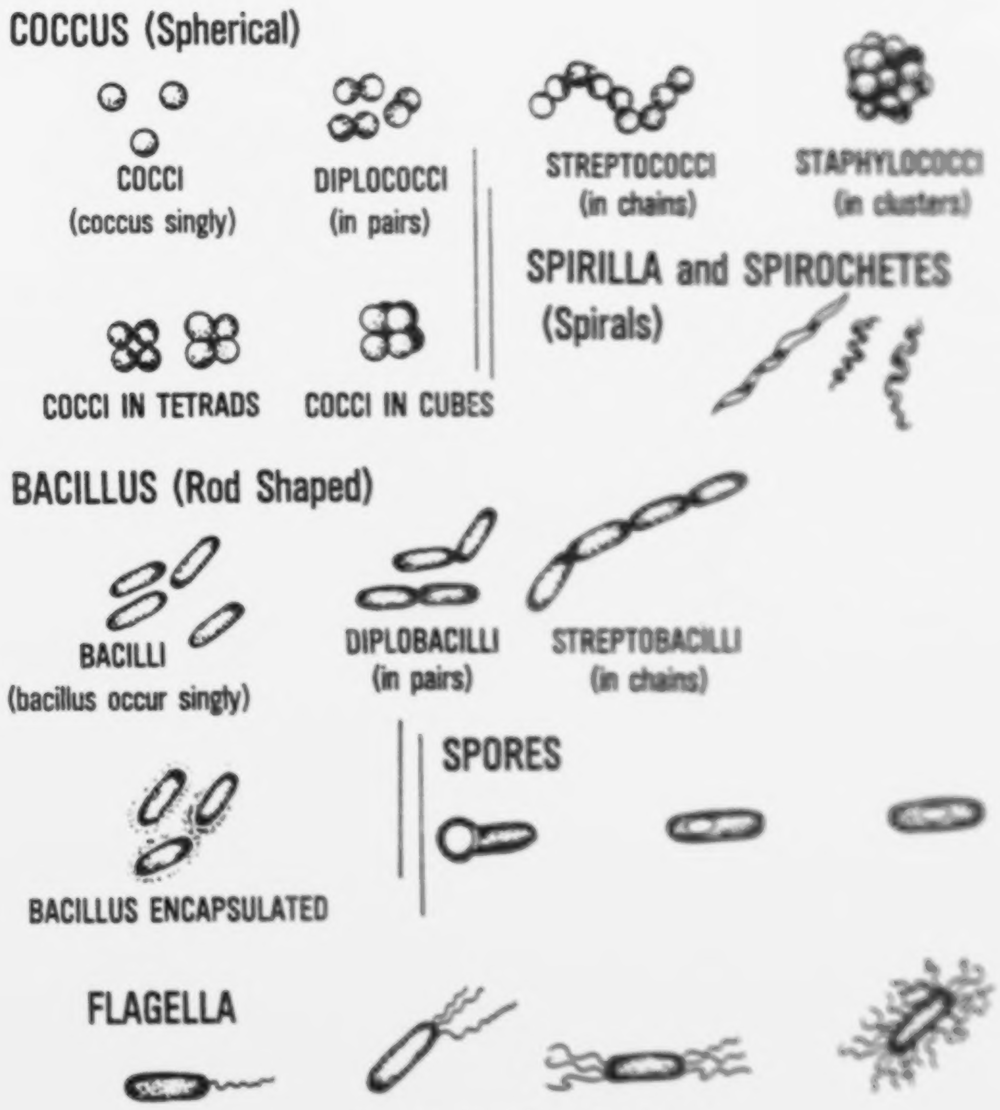

Figure 2-11. Morphology of bacteria.

spring. They may be short or very long. They always appear as individual cells and do not form clusters or chains.

The pairing, chaining, or clustering of bacterial cells is a result of the organism's method of reproduction. The cells multiply by a process called binary fission (fission is splitting; binary means "two"). One organism splits into two organisms just like the parent cell.

Exercises (015):

1. Briefly describe bacteria.

2. What is the main criterion used for bacteria identification?

3. What is another factor to consider in identifying bacteria?

4. Match the shape from column A with the appropriate type of bacteria in column B.

Column A	*Column B*
___ (1) Spiral.	a. Coccus.
___ (2) Spherical.	b. Bacillus.
___ (3) Rod.	c. Spirilla.

5. What is the process of bacterial cell multiplication called?

016. State the purpose and give examples of bacterial special structures.

Special Structures. Some bacteria have special structures that aid in motility or survival in nature. Many bacteria possess an outer coating known as a capsule. Some bacteria have capsules so thin that they are undetectable, others have very thick, sticky capsules which are believed to aid in the organism's defense against the white blood cells in the body, and possibly some other hazards the cell may encounter in nature. To enable them to move about, some of the bacilli have special structures called flagella. A flagellum is a hair like appendage that whips back and forth and either pulls or pushes the organism about. Some cells have a single flagellum on one end. Others have one on each end. Still others have several flagella on one or both ends, while still others may be completely covered with flagella. The sole purpose of the flagella is to provide a means of movement.

Another of the special structures that develop in certain bacteria is the spore. Any time these organisms find themselves in an unfavorable environment, they concentrate their protoplasm into a little round ball (the spore) and become extremely resistant to the unfavorable condition. When the spore is formed, you can clearly see the rigid cell wall with the little round ball inside. This spore formation enables the organism to survive conditions that normally destroy bacteria. One species, *Bacillus anthracis*, has been known to live for as long as 40 years outside of the animal body, and some spores can withstand boiling for as long as 5 hours.

Exercises (016):

1. Why do some bacteria have special structures?

2. What is the outer coating on bacteria called?

3. What structure enables some bacilli to move?

4. Certain organisms form a spore for protection against unfavorable conditions that normally destroy bacteria. (True or False)

017. Associate terms used to describe environmental requirements of bacteria with the correct descriptive phrases.

Environmental Requirements. We can expect to find almost as many different environmental requirements as there are different kinds of bacteria. A particular bacterium, in order to reproduce or grow, must have the proper temperature, nutritional requirements, moisture, and pH. To all of these we must add the oxygen requirements. We will discuss these environmental requirements in general, without being concerned about specific organisms. However, we will show how these factors relate to the problems of food spoilage and food establishment sanitation.

Temperature. Temperature is a very critical requirement for bacteria, so much so that they are classified according to their optimum growth temperatures. The classifications of bacteria according to their temperature requirements are:

a. Psychrophilic — cold-loving.
b. Mesophilic — medium temperature-loving.
c. Thermophilic — heat-loving.

Psychrophiles, the cold-loving bacteria, grow in temperatures from 32° F. to 86° F. (0° C. to 30° C.). They grow best at about 68° F. (20° C.). These bacteria, when present in food, cause undesirable flavors to develop and decrease keeping qualities. The presence of psychrophilic bacteria in milk, after pasteurization and cooling, indicates poor sanitation during processing.

Mesophiles, or medium temperature loving bacteria, are those organisms that require temperatures close to body temperature range of 50° F. to 113° F. (10° C. to 45° C.), with normal human body temperature (98° F. (37° C)) the ideal. From a public health viewpoint, mesophiles are of particular importance because all known pathogenic (disease-causing) bacteria fall into this group. Food should not be kept at temperatures that support the growth of mesophiles. Some pathogenic bacteria grow quite well in certain foods and, in turn, cause foodborne illnesses in humans. Great importance is placed on not allowing foods to be maintained at temperatures within the "danger zone" of 45° F. to 140° F. (7° C. to 60° C.), and certainly not for more than 4 hours. This is long enough for bacteria to produce enough toxins, or to reach sufficient numbers, to make the food dangerous to eat.

Thermophilic bacteria are not known to be pathogenic. They grow at high temperatures (104° F. to 164° F.) (40° C. to 73° C.). Their optimum growing temperatures are from 122° F. to 131° F. (50° C. to 55° C.). You will find that thermophiles usually appear as "pinpoint" colonies on plates incubated at standard plate-count temperatures (89° F. to 97° F. (32° C. to 36° C.)), because these incubation temperatures are below the optimum for the thermophiles.

Nutrients. Since a bacterium has no mouth and absorbs its food directly through its cell membrane, its food must be part of its environment. Different kinds of bacterial organisms have different nutritional requirements, so you can begin to see why some bacteria are found in one substance while other organisms are found in another substance.

Moisture. Bacteria require moisture to multiply and grow; in fact to stay alive. This is an important fact that is utilized in food preservation. Foods are dried in a variety of ways, all of which remove available moisture and prevent the growth of bacteria. It is usually bacterial growth in food that results in spoilage. Thus, by preventing the growth of bacteria, this type of food spoilage is also prevented.

pH. Another important factor in the growth of bacteria is the pH (relative acidity or alkalinity) of the environment. Each type of bacteria has a specified pH at which its growth is optimal. This is another factor that is used in food preservation. Susceptible foods are often protected by being made more acid, thus making them incapable of supporting the growth of most bacteria.

Oxygen. Different microorganisms have different oxygen requirements. Some organisms use atmospheric oxygen and are called aerobic organisms. Anaerobic organisms require an environment where there is no free oxygen. Facultative organisms are able to live under either aerobic or anaerobic conditions.

Exercises (017):

1. Match the most appropriate description in column A with the items in column B by writing the correct letter in the blank provided.

Column A	*Column B*
___ (1) Use atmospheric oxygen.	a. Psychrophilic.
___ (2) Optimum growing temperatures are from 122° F. to 131° F. (50° C. to 55° C.).	b. pH.
___ (3) Cause foodborne illnesses.	c. Aerobic.
___ (4) Measure of relative acidity or alkalinity.	d. Thermophilic.
___ (5) Require temperatures close to body temperatures.	e. Facultative organisms.
___ (6) Able to live under both aerobic and anaerobic conditions.	f. Pathogenic bacteria.
___ (7) Cold loving.	g. Mesophilic.

018. Cite terms used in relation to the Gram stain procedure as well as those used to describe the process of cultivating bacteria.

The Gram Stain. Bacteria, because of their small size, are difficult to see even with a good microscope unless they are properly stained. They may be stained with almost any aniline dye, but the most common staining reaction used in bacteriology is the Gram stain procedure. It is used because it differentiates between two major groups of bacteria. Almost all bacteria may be placed in one of two groups: Gram-positive or Gram-negative. Those organisms that are Gram-positive have a substance in their protoplasm known as magnesium ribonucleate. The presence of this substance is determined by the Gram staining reaction. The organisms are first stained with crystal violet stain, which unites with the ribonucleate. Next they are placed in an iodine solution. The iodine serves as a mordant or fixative that causes the crystal violet stain to become fixed to the ribonucleate substance. Ethyl alcohol is then flowed over the slide and the "unfixed" stain is washed away. Naturally, if the ribonucleate substance is no present, all the crystal violet stain is washed away. If ribonucleate is present, the fixed portion of the stain remains in the organism. After the alcohol destaining process, the organisms are subjected to a secondary stain which is usually safranine red. Any stain will suffice as long as it contrasts well with crystal violet. Those organisms with the ribonucleate substance are blue or violet and are Gram-positive, while those without ribonucleate stain red and are Gram-negative. Thus, the Gram stain procedure not only stains the bacterial cell so that it may be seen, but also aids in its identification by placing it into one of two major categories.

Cultivating Bacteria. It is almost impossible to study or identify a single bacterial cell. Therefore, we grow or culture bacteria in the laboratory under controlled conditions. Bacteria are cultured by placing them into a nutrient substance at a temperature that meets their environmental requirements. This substance is called a culture medium. It must contain the nutritional requirement, proper moisture, and have sufficient buffers in it to resist adverse changes in pH caused by some of the waste products of the bacteria. If all the nutritional and environmental requirements are met, the organisms reproduce, some of them as often as every 15 minutes. The organisms continue to grow and reproduce as long as the conditions remain favorable. If the culture medium is a clear liquid, the growth is obvious after a few hours. The liquid becomes cloudy. If the medium is a semisolid, the organisms grow into a visible colony on the culture medium. The characteristics of the colony are noted and are major factors used in the identification of the organisms.

Selective media. We may add certain chemicals to culture media that allow some bacteria to grow and inhibit the growth of others. One chemical additive is NaCl (sodium chloride; table salt). While some organisms grow well in high concentrations of NaCl, others cannot grow at all. This is also a factor in an organism's identification. These chemical additives are called inhibitors. When they are added to a culture medium, the medium is called an inhibitory medium or a selective medium, meaning that it will sustain the growth of only select organisms.

Differential media. Other media contain chemicals that cause the bacteria to produce specific colors in the media or in the colony itself. These are known as differential media. Media production has become so well developed, is so selective, and so differentiating that most pathogenic bacteria can be placed in specific groups and some can be completely identified by the use of culture media and the Gram stain alone.

Exercises (018):

1. In what two groups can all bacteria be placed?

2. What is the substance used to culture bacteria called?

3. Which medium sustains the growth of only select organisms?

4. Which media contain chemicals that cause the bacteria to produce specific colors in the colony itself?

5. What is the substance that Gram-positive organisms have in their protoplasm?

6. Describe Gram-negative organisms and the results of the Gram-stain test for them.

019. Cite characteristics of organisms that produce toxins and give terms used to describe this process.

Toxin Production. As the organisms grow, they produce waste products and sometimes excrete other substances used in digestion. These products may be poisonous to us; if so, we call them toxins. Toxins produced and excreted by living organisms are called exotoxins. As bacteria die and break up, some of them release toxins from inside the cell, and these are called endotoxins. In either case, these are the substances that make bacteria harmful. Organisms may produce endotoxins or exotoxins that have a direct effect on the cells of your body, or they may be introduced into a food substance and contaminate it with toxins. When we eat the food substance, the toxins are absorbed and poison our bodies. Some of these toxins are destroyed by heat and are known as thermolabile toxins. Some toxins are not affected by heat and are called thermostable toxins. Cooking the food may kill the bacteria but does not necessarily make it safe to eat. Also keep in mind that food can have sufficient toxin to cause illness but have no off odor, color, or taste.

Exercises (019):

1. What term is used to describe toxins produced by living organisms?

2. What are toxins that are destroyed by heat called?

3. What are toxins released inside the cell called?

4. What word describes toxins that are not affected by heat?

5. Cite the characteristics of some toxins that make detection of certain contaminated foods difficult.

020. Describe fungi and viruses and state the special reason for studying fungi.

Fungi. The fungi make up an extremely large group of plants containing thousands of species. Some are parasites of animals,including man. Many skin diseases, such as ringworm and athlete's foot, are caused by fungi. Other fungi cause the spoilage of bread, fruits, vegetables, and other foodstuffs.

Not all economically important fungi are pathogenic or destructive; many are beneficial to man. Yeasts (single-celled fungi) are used in the manufacture of alcohols, cheeses, and some antibiotics. You should also be familiar with the role of yeast in the production of breads and other bakery goods.

The fungi of primary importance to use are the yeasts and molds. They have no roots, stems, or leaves, and no chlorophyll. Without chlorophyll they cannot produce their own food; therefore, they must depend upon some other food source — such as dead or decaying matter, a manufactured food product, or a living organism. Those species receiving nutrition form dead or decaying matter are saprophytes; those gaining nutrition form living organisms are called parasites.

Fungi reproduce sexually or asexually. The asexual method is known as budding. A portion of the cell swells to a certain size, then seems to pinch off from the parent cell. Yeasts reproduce in this manner. In sexual reproduction the cells branch and form male and female reproductive cells which unite and cause the production of spores. These spores contain all the ingredients necessary to produce another colony. Molds produce several types of asexual spores, one of which is shown in figure 2-12. Note the different appearance of the conidiophores of the three general illustrated, Aspergillus, Penicillium, and Hormodendrum. Some fungi are capable of both sexual and asexual reproduction.

Yeasts. The yeasts are round or oval and are much larger than bacteria. They have a large vacuole that takes up a good portion of the cell — usually there are a few large granules between the vacuole and the cell wall. The internal characteristics are of no importance in their identification, because their identification is based almost entirely on the type of colony the yeast produces. The colony may be rough or smooth; its margins may

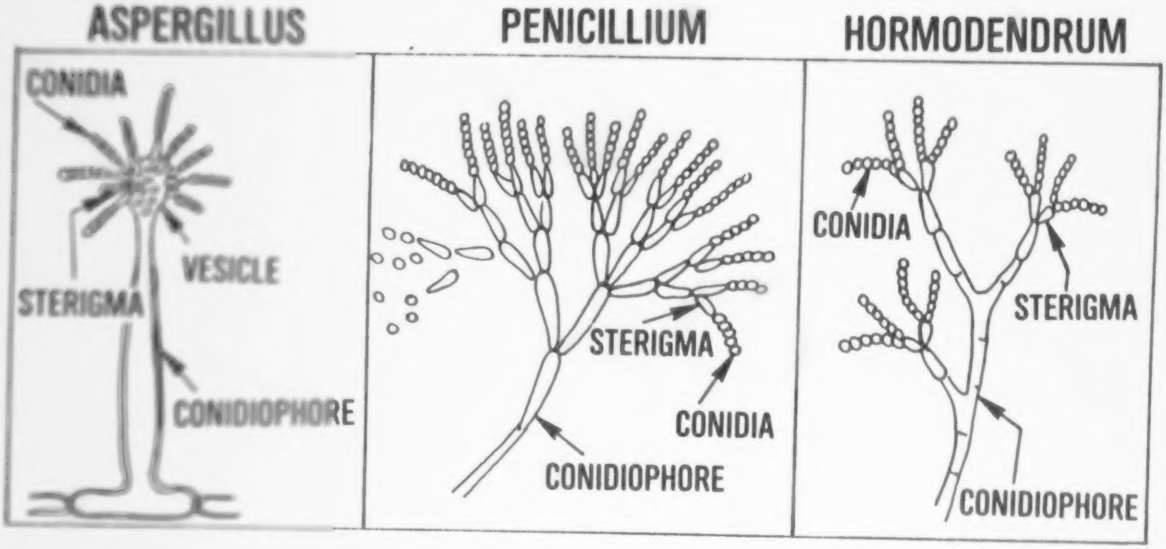

Figure 2-12. Asexual spores (conidia) are produced at the tips of fertile hyphae.

be entire (unbroken) or irregular. It may appear dry or moist, and it may be any color in the spectrum. Some consideration is given to the nutritional and environmental requirements of the fungus; however, these factors are not nearly as critical as with bacteria. Yeasts reproduce asexually (by budding, by transverse fission, or by sporulation) or sexually. The three asexual methods are illustrated in figure 2-13.

Molds. As the molds grow, they produce flowery looking colonies of many colors. If you look very closely at one of these colonies, you will see many hairlike structures called hyphae (hi fee). After a period of time, you will discover little beadlike or podlike objects associated with the hyphae connected nodes from which other hyphae and rhizoids arise. Rhizoids are rootlike filaments that arise at nodes and attach to the substrate (nutrient source). They are found in *Rhizopus nigicans* (common bread mold). This particular fungus, as shown in figure 2-14, forms rootlike hyphae (rhizoids), vegetative hyphae that penetrate the subtrate, and fertile hyphae that produce sporangia at the tips of sporangiophores (spore-producing hyphae). Stolons are rootlike filaments which connect individual plants. You can learn to recognize some of the more common molds at a glance, but it is best to leave the identification to a qualified laboratory.

Fungi are very difficult to control. Spores are found on everything; they blow around in the air and can grow on almost anything that hints at being a food substance. Some fungi even grow on wet wood or paper. Temperature variation doesn't seem to be too vital to them, though different temperatures change some of the colony characteristics. In some cases, a fungus will develop as a yeast at one temperature and as a mold at another temperature. Because of its prevalence in nature and its association with diseases, food spoilage, and industrial uses in food and medicine production, it is of prime concern to the Environmental Health Service.

Exercises (010):

1. Yeasts are important in the manufacture of what items?

2. What are fungi receiving nutrition from dead or decaying matter called?

3. In sexual reproduction of fungi, the cells branch and form male and female reproductive cells which unite and cause the production of what type of organisms?

4. The yeasts are round or oval and are much larger than what other organisms?

5. Cite the three methods by which yeasts reproduce asexually.

6. Rhizoids are rootlike filaments that arise at nodes and attach to which structure?

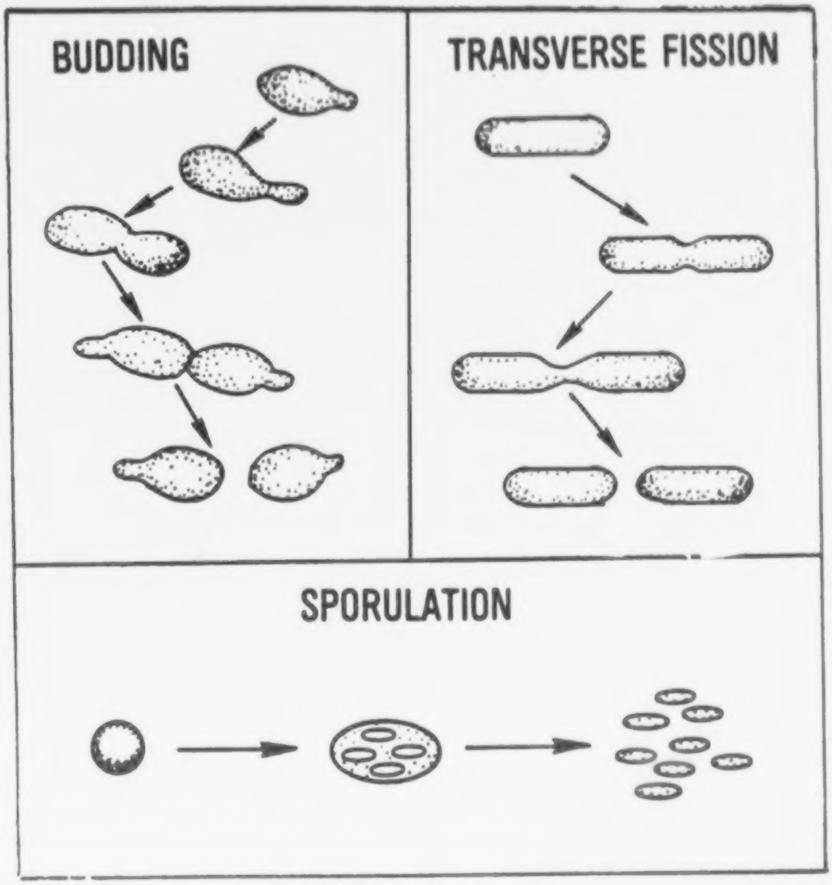

Figure 2-13. Reproduction of yeasts.

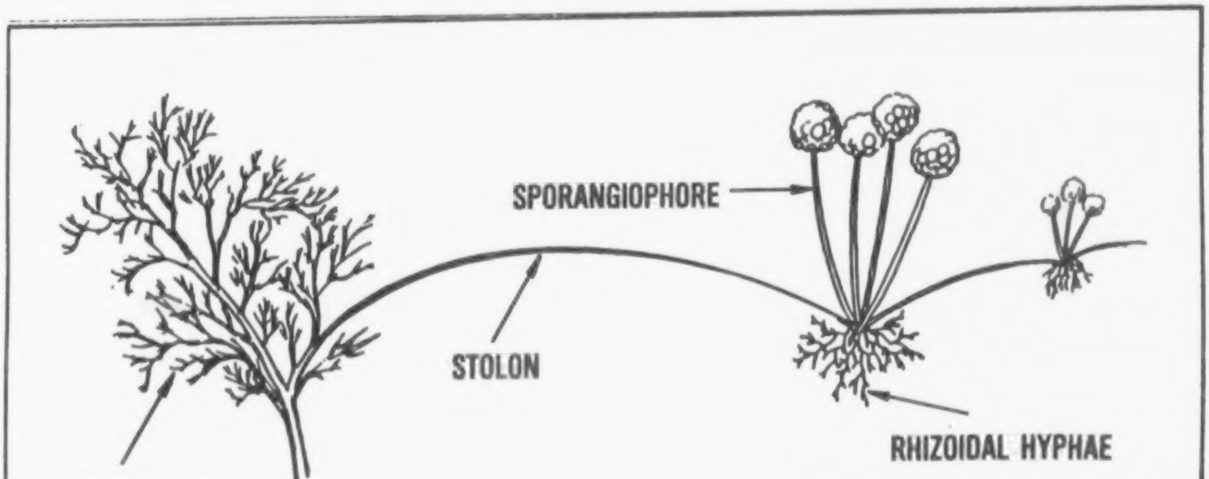

Figure 2-14. *Rhizopus nigricans* (common bread mold).

7. What do stolons (rootlike filaments) connect with?

8. What is the common name for *Rhizopus nigricans*?

9. A fungus may develop as a yeast at one temperature and as what type of organism at a different temperature?

10. Why is the study of fungi of such importance to the Environmental Health Service?

021. State characteristics of rickettsia, protozoa, and viruses.

Rickettsia. The Rickettsiae are small, Gram-negative bacteria which multiply only within living host cells. Many are transmitted by arthropod vectors. These organisms are rod-shaped or coccoid and often "pleomorphic" (has more than one distinct form). They are not motile but do have typical bacterial cell walls. These organisms can be parasitic or "mutualistic" (a mutually beneficial association between different kinds of organisms). The parasitic species may be found in the endothelial cells or red blood cells within the human body as well as in arthropods that serve as primary hosts or vectors of disease-causing agents.

Some of the rickettsial diseases include typhus fever and Rocky Mountain spotted fever. The primary vector involved in the spread of typhus fever is the body louse. The bacteria multiplies within the digestive tract of the arthropod. The rickettsiae in the louse feces are introduced into the skin in the process of scratching a louse bite. The organisms then travel to the blood vessels and are carried throughout the body.

Protozoa. The protozoa are the smallest of all the animals. They range in size upward from a little less than the diameter of a red blood cell. Most of them, however, are visible to the naked human eye. There are approximately 25,000 species recognized within the phylum protozoa.

Apart from being parasites and causing disease, protozoa are of concern as nuisances and as helpful organisms of decomposition. They are widespread in water and may affect its color, taste, or odor. Some species produce green or red colors; others liberate aromatic oils that cause fishy or cucumber odors, bitter or spicy tastes.

Protozoa are abundant in the soil and contribute to its fertility. One gram of rich garden soil may contain approximately 10,000 to 100,000 protozoa. They are important because they digest particles of insoluble organic matter and liberate soluble waste materials that can be utilized readily by plants. Many protozoa feed on bacteria and other microorganisms and therefore preserve the balance of nature.

A large number of protozoa "withdraw from the world" when conditions become unfavorable and enter into a dormant state, called encystment. This may occur when food or water supplies become inadequate, too little oxygen is available, or when the environment becomes otherwise unsuitable for their life cycles. Cysts are more resistant to drastic environmental changes (such as heat, cold, chemicals, and lack of food), thus assuring (by the encystment stage) their survival when these changes occur. Some examples of protozoan diseases are malaria and amebic dysentery.

Viruses. There is still another disease-causing entity that we have not yet discussed. These are the ultramicroscopic agents called viruses. In the past few years, vast amounts of knowledge have been gathered about them, but they are still a mystery to people outside the field of virology. They are so different from the other disease-causing agents that they cannot be compared with any of them. They are not known to be plants or animals and only a few can be seen with an ordinary microscope. They do not fit our present biological definition of "living" organisms, nor do they die. They merely inactivate or disassociate themselves. They do not reproduce themselves, but cause a living cell to replicate or reproduce them. They cause a wide variety of diseases in plants, animals, and man. Measles, herpes, influenza, and smallpox are examples of some diseases caused by viruses.

Exercises (021):

1. How do viruses reproduce themselves?

2. Why is an ordinary microscope not practical for use in virology studies?

3. Rickettsia are parasitic or mutualistic and multiply only inside host cells. (True or False)

4. What organism causes Rocky Mountain spotted fever?

5. Protozoa are the smallest of all animals. (True or False)

6. Which type of organism causes malaria and amebic dysentery?

CHAPTER 3

Principles of Epidemiology

THE TERM "epidemiology" is derived from the word "epidemic," which originates from the Greek word "epidemios" meaning "upon the people." Epidemiology is defined as the study of the various factors which determine the frequency and distribution of a disease in humans. For example, how often does the disease occur; how many people are affected; where does the disease occur?

There is no single cause for any disease. For instance, simple presence of a disease agent (bacteria, viruses, fungi, etc.) in the environment is not enough to explain a disease outbreak. *Clostridium botulinum*, the disease agent involved in botulism, is generally present everywhere in our daily environment; only when several conditions are met does an outbreak occur. To prevent and control human disease due to infectious agents, you must understand how disease agents exist in nature and the means by which they reach humans. In this chapter, you will learn the principles of infectious disease epidemiology.

3-1. Host-Parasite Relationships

To understand any communicable disease process, you must first understand the relationship between the host and the parasite (disease agent).

022. Describe host-parasite relationships and the conditions required for the host-parasite relationship to exist.

Host. A host is a human or other living organism (animals, birds, arthropods, etc.) that provides a disease agent (parasite) a home to live in. Some agents (such as protozoa and helminths) pass successive stages of development in two or more different species of hosts. For example, in one form of tapeworm disease in humans (diphyllobothriasis), the eggs in the tapeworm segments are discharged into fresh water where they hatch and infect very small shellfish. These shellfish are later eaten by susceptible fish and then the tapeworm larva go through another stage of their development in the body of the fish. Later a human may catch this fish and eat it raw or under-cooked. The larval tapeworms will develop to maturity in this human and start producing more eggs to start the cycle all over again. The human is called the "primary" or "definitive" host because the tapeworm attains its maturity and goes through its sexual stage (produces the eggs) in the human. The shellfish and freshwater fish are called the "secondary" or "intermediate" hosts because the tapeworm is in a larval (asexual) stage and does not go through a sexual stage — does not reproduce. Humans, small mammals, birds, and arthropods are just a few examples of hosts.

"Carrier" is another term that applies to the host. A "carrier" is an infected host that harbors a disease agent but has no clinical signs of disease. This host is a potential source of infection to others. The "carrier" state may last for a lifetime (as in the case of Typhoid Mary) or it may last for a few weeks (as often happens with carriers of *poliovirus, diphtheria bacilli*, and *streptococci*). In investigating outbreaks of disease which have disease agents that can cause "carrier" states, finding the source of infection may be very hard since you would be looking for a host who does not appear ill.

Parasite. Parasites (disease agents) are organisms that live on or in the body of a host. The parasite lives at the expense of the host. Even though disease agents may cause some damage to the host, they usually don't cause death. There are exceptions. For example, the virus that causes rabies almost always kills the host. All living organisms carry disease agents on or in themselves. Almost any location on the host's body may be occupied by disease agents. Viruses, and some bacteria, invade and multiply right within the very cells of the host. Most often you will hear the term parasite used to refer to the "higher" level of disease agents such as hookworms and roundworms.

A term frequently used in the description of a particular disease agent is "pathogenicity." This is the capability of the disease agent to cause disease. Or another way to say it is how strong is the disease agent? Can it overcome the host defense system (which will be discussed later)?

Host-Parasite. When a host comes in contact with a disease agent, there are three possible outcomes. One, the disease agent will not be able to penetrate the host's body or will penetrate but not be able to lodge somewhere before being eliminated. Second, the agent may enter and lodge in the host's body but not multiply to sufficient numbers to cause symptoms of disease (subclinical disease). Or third, the disease agent may lodge and multiply, causing signs and symptoms of disease (clinical disease).

As you can see, several conditions are required for a disease agent to be infective: penetration, lodgement, and development. In humans and higher animals, the disease agent normally enters the body in one of three ways:

(1) It may be swallowed, ingested with food or drink, or after putting fingers, cigarettes, or other materials in our mouths.

(2) It may be inhaled with the air we breath.

(3) It may penetrate the skin, enter through a cut or as part of an insect bite, etc.

Once in the body, the disease agent must find the right place to live. Most disease agents can only live in a certain type of cell or organ. We call these cells or organs where the disease agent lives, the agent's target cell or target organ. Some agents live in the intestines while others may live in the blood or perhaps in the respiratory tract.

Additionally, the agent must be able to reproduce itself in order to survive. For example, once inside the body the tapeworm lays approximately one million fertilized eggs. Why so many? Species survival depends on it!

Lastly, the young disease agents must be able to exit the target organ and survive outside of the host until they enter a new host.

Exercises (022):

1. Define a "host."

2. Define a "carrier."

3. Give examples of hosts.

4. What are disease agents?

5. Describe the effect disease agents usually have on the body.

6. When a host comes in contact with a disease agent, what are the three possible outcomes?

7. Give some examples of parasites.

8. Cite the three conditions required for a host disease agent condition to exist.

9. What are the three main modes of entry for disease agents into the body?

3-2. The Chain of Infection.

Communicable diseases are those illnesses which can be transmitted from a reservoir such as person to person or from animal to person. The term "communicable disease" is synonymous with "infectious diseases." Communicable disease may result from close or direct contact with an infected person or animal; from exposure to the breath, cough, or bodily discharges (sputum, mucus, urine, feces) of such a person or animal; from foods, liquids, or articles contaminated by an infected person or animal; or from the bites of humans and/or animals. Communicable diseases are transmitted by direct contact, food, water, milk, air, insects, rodents, and contaminated inanimate (nonliving) materials.

In previous sections of this volume we have discussed organisms that cause communicable diseases (i.e., viruses, rickettsia, protozoa, bacteria, yeasts, molds, and worms). Most of them were too small to be seen except with a microscope. Some of them could survive for only a few minutes outside the human body, whereas others could survive for years in human's general environment. When these infectious organisms enter the human body and begin to multiply or reproduce, they cause communicable diseases. The chain of infection describes how these diseases are spread to others.

023. State characteristics of the elements in a chain of infection and how this chain may be broken.

Elements of the Chain. Each case of communicable disease is a result of a orderly progression of a series of events. This series of events may be explained using a three-link chain; each link represents a factor or factors essential to the transmission of disease. These links are (1) the source of the disease (2) the means by which the disease may be transmitted (mode of transmission), and (3) a susceptible person (host). If any one of the links in the chain is broken, disease does not spread (fig. 3-1).

Sources of disease. The source of disease may be a case, a carrier, or an animal to name a few. A case is defined as a person who is actually ill with a disease. A case may serve as a common source of infection. A person who harbors disease organisms, but who is not ill, as discussed earlier, is called a carrier. The carrier can spread the germs in the same manner as a case. Carriers are more dangerous because they may not know that they are harboring infectious organisms. Animals may also be sources of infection. They may be ill with the disease, or may harbor the organism, much like human carriers do. By "animal" we mean any member of the animal kingdom, from insects to mammals.

Means of disease transmission. How the infectious agent gets from a source to a susceptible individual is by the "means of a transmission" link in the chain of infection. Some examples are: physical contact, droplets, air and dust, insects, food, water, and fomites.

Physical (direct) contact. Many diseases are spread by physical contact (e.g., touching, kissing, and sexual intercourse) with an infected person. Some examples of diseases transmitted by physical contact are hepatitis, meningitis, most enteric diseases, syphillis, gonorrhea,

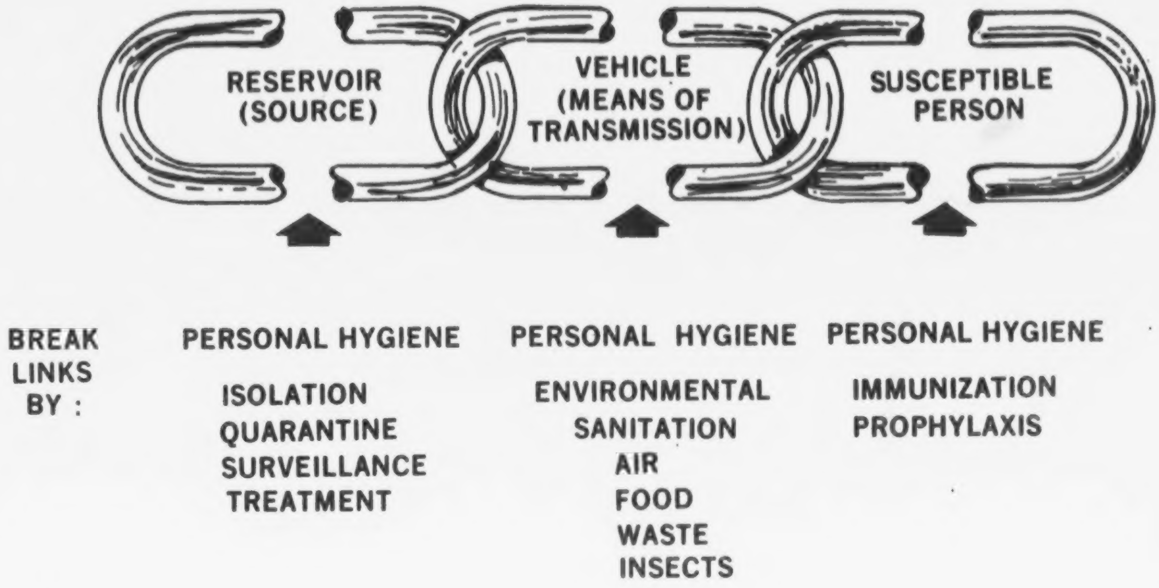

Figure 3-1. Chain of infection.

scabies, and some forms of staphylococcal infections.

Droplets, air, and dust. Droplets may act as vehicles by which disease may be transmitted from an infected person to susceptible persons. When an infected person coughs, sneezes, or even talks, he or she spreads water or saliva droplets containing disease organisms. If other persons are close to the infected person, they may inhale some of these droplets. Furthermore, some germs expelled from the respiratory tract are extremely small and lightweight and may remain suspended in the air for hours or may be resuspended in dust. Many of the respiratory diseases are transmitted in these ways.

Arthropods. Flies, fleas, mosquitoes, ticks, mites, and lice are among the vectors (properly called arthropods) that spread disease from person to person or from animal to person. A female mosquito, for example, can pick up disease organisms when she bites a person sick with a disease such as malaria. Later, when the mosquito bites another person, it injects the disease organisms. The mosquito serves as the means by which the disease is transmitted from one person to another person. The fly, on the other hand, transmits disease organisms a little differently. It can pick up disease organisms on its body when it comes in contact with filth, such as animal droppings, garbage, etc., and may deposit these organisms on food. If a person eats this food, he or she may become ill.

Water and food. Certain disease organisms are transmitted through the consumption of foods such as unpasteurized milk, raw fish, and improperly cooked meat and poultry. However, most of the diseases that are transmitted by food and water are the result of contamination with feces, urine, or other infectious material from a person or animal. If contaminated water or food is not properly treated, the pathogens may infect the consumer. Outbreaks of disease will occur if personal hygiene, proper food handling, and waste disposal sanitation practices are not followed. Flys and other pest control measures must also be propely observed and enforced. Some of the significant diseases commonly transmitted by contaminated food or water are typhoid fever, hepatitis A, salmonellosis, shigellosis, giardiasis, cholera, and dysentery.

Fomites. Articles contaminated with disease organisms (infectious waste) may become vehicles for disease transmission if a susceptible person uses them. Examples of fomites are contaminated clothing, bed linen, and eating utensils. The handling of fomites can be a problem when patients with communicable diseases are hospitalized. There are a variety of isolation precautions, depending on the disease organism involved, that are used by hospital personnel to stop transmission of the disease agents. Ideally, infectious waste is incinerated in an incinerator designed especially for infectious waste or sterilized in an autoclave prior to disposal (in a dumpster) of the infectious waste.

Susceptible person. A susceptible or nonimmune person is one who has little or no resistance to a particular organism and who, if exposed to this organism, is likely to contract disease. By contrast, an immune person is one who has a high degree of resistance to the organism and who, when exposed, does not develop the disease. In some cases, immunity to many diseases is relative and can be overwhelmed by exposure to a very large number of disease organisms.

Breaking the Chain. The control measures for sick individuals (cases), carriers, and animal reservoirs (i.e., the sources of infection) include personal hygiene, isolation, quarantine, medical surveillance, and treatment.

Personal hygiene. The spread of germs from infected individuals can be prevented or greatly reduced by carefully observing good personal hygiene and sanitation practices. Frequent handwashing is the single most effective personal hygiene practice in stopping disease transmission. Covering the mouth when sneezing, bathing and wearing clean clothing daily, etc., are examples of good personal hygiene.

Isolation. Isolation is a procedure whereby infected individuals, cases or carriers, are separated from noninfected persons. This separation may be done by having the infected individuals admitted to an isolation ward in a hospital. Clothing, linens, and other articles used by infected individuals may need to be disinfected and then washed or cleaned by appropriate methods to prevent the spread of disease to others. As stated earlier, infectious waste should ideally be incinerated or sterilized before it is disposed of.

Quarantine. This is the restriction of individuals who may have had significant contact with disease cases and who may be infected, but do not have symptoms. Normally, they are restricted to their homes for the duration of the incubation period.

Medical surveillance. Surveillance is carried out in two ways: (1) by routinely recording new cases, and (2) by examining all exposed personnel to detect cases early and to prevent an epidemic.

Treatment. All cases of disease are treated (if treatment is available) as soon as the occurrence is known, thus destroying the disease organisms and decreasing the probability of further spread.

Exercises (023):

1. What are the three elements of the chain of infection?

2. What may serve as a source of infection?

3. Explain three ways disease agents may be transmitted fom the source to a susceptible individual.

4. How may the chain of infection be "broken" at the susceptible individual link?

5. How can you "monitor" disease trends in a population?

3-3. Distribution of Disease

Why do we get sick? Why do some people get sick while others (having the same exposure) may not? These questions are asked by many of us when someone we know gets sick or dies. In this section we discuss some of the factors involved in the occurrence of disease. First, we consider the body defenses.

024. State how host defenses affect disease transmission.

Body Defenses. The intact skin and mucous membranes provide the body with a protective covering against living agents and many chemicals. Other structures such as the hair, sweat glands, and fat pads help to protect the body against physical forces and aid in thermal regulation. Even the respiratory system is designed to keep large particles out of the lungs (e.g. the cilia (hair) in the nose). The skeleton protects the delicate vital organs such as the brain, heart, lungs, and abdominal organs. Within the abdominal area the cavity is well lubricated so that the organs will slide out of line of direct pressure and sharp objects.

Our senses also help to protect us from danger. Coughing or sneezing is an effort of the respiratory system to get rid of harmful substances. Our eyes "wink" and tears have a cleansing action, thus providing protection against objects or pathogens. The cilia within the upper respiratory tract which constantly beat move a layer of mucus with trapped particles to the outside. The body itself develops a tolerance to certain chemicals (i.e., alcohol and nicotine) so that larger doses are necessary to harm it. Vomiting and diarrhea are defense mechanisms of the gastrointe chemicals are rapidly released from the body and the body tries to filter out or detoxify other chemicals through organs like the kidney and liver. The body also has internal defenses against disease agents (such as bacteria) that gain access to the body. Inflammation at the site is an attempt by the body to wall off and destroy the "harmful" agents. Numerous white blood cells (WBC) go to the scene to try to surround and engulf the agents. Also, pathogens are moved via lymph channels to lymph nodes (filter-like structures) lined with other WBC's. Even if all these fail and the pathogens still evade these defenses and get into the blood stream, large filters with white blood cells (located in the bone marrow, liver, and spleen) await them. Viruses are harder for the body to defend against because they live inside the body's cells most of the time. They are however, very susceptible to antibodies during the time they are outside the cells (extracellular).

Exercises (024):

1. How do the skin and mucous membranes protect the body?

2. State two other protective structures the body has.

3. How is the abdominal cavity designed to protect the vital organs?

4. Describe functional ways the respiratory tract protects itself.

5. By what functional way does the gastrointestinal tract protect the body?

6. How does the body defend itself against living pathogens?

025. Describe how age, sex, and ethnic group or race are involved in disease distribution.

Intrinsic (Inherited) Factors. In analyzing any disease outbreak, age, sex and ethnic group or race characteristics are some of the first things you will want to determine in relation to the disease occurrence. These host characteristics usually relate to disease occurrence in basically one or more of three ways: by determining degree of exposure, differences in the susceptibility, and the possibility of any specific immunity in the population at risk.

Age. Young children's defense mechanisms to disease are poorly developed. This is why infants (less than 1 year old) have very high mortality rates (death rates), especially in developing countries. Their immune systems just can't fight disease organisms as well as an adult or older child. As we get older, our defense mechanisms get stronger and more developed. But we also start coming in contact with more people and things that may be a source of disease. At first we are allowed to play in our own yard. As we get older, we can play across the street and in the neighborhood. At five or six, we start school, and so on through life. Each stage of our life brings us in contact with new people and places that may be sources of disease. We develop immunity to many diseases such as measles, poliomyelitis, and chickenpox as children and are protected for life. As we reach the later years of our lives, our defense system starts to weaken and we are more susceptible to disease again. Other disease such as strains of influenza and species of bacterial pneumonia may overcome our defense mechanisms, especially when they are weak (very young or very old).

Sex. Sex affects the distribution of disease due to three factors: anatomical differences, hormonal factors, and exposure potential. Older men frequently develop prostate infections. Women don't have a prostate organ. Urinary bladder infections are more common in females than males because of the different anatomy of the urinary tract. Estrogen (one of the female hormones) seems to protect against some diseases. Pregnant women are more susceptible to poliomyelitis due to low levels of estrogen during pregnancy. Also, after menopause (again lower levels of estrogen) females are more susceptible to hepatitis A. What about exposure potential? In many societies, the women is the one responsible for nursing a sick child and therefore more exposed to the infecting agent. These are just a few examples of sex differences.

Race or ethnic group. You can probably already think of some examples of disease differences in race such as sickle cell anemia in the Black race. Did you also know that tuberculosis is more of a problem in the Black race and that diabetes is more common in Jewish males? Some of the reasons are known and others are just theories, yet to be proven. Some of these differences may be due to exposure potential as was the case in sex and others may be due to race immunity and defense system difference.

Exercises (025):

1. State why age is an important factor in disease transmission.

2. How is the age of a population at risk a factor affecting disease occurrence?

3. What two factors may be involved in disease transmission within various ethnic groups?

026. Describe how the general health status of the host is involved in the incidence of disease.

General Health Status of Host. In addition to the structural and functional aspects of the human body, the general health status of the host is a significant factor in disease occurrence. The general health status of the host includes his or her physiologic state, nutritional status, pre-existing disease, and stress.

Physiologic state. Puberty, with its rapid growth and changes in the body, appears to contribute to the occurrence of such different diseases as acne and TB. Pregnancy also enhances the risk or tuberculosis and clearly predisposes the body to infection of the urinary tract, as was discussed earlier.

Nutritional status. The nutritional status can definitely affect the frequency with which certain diseases occur. As the body's nutrients are depleted due to poor diet, less energy can be used to produce antibodies and white blood cells which fight off disease agents. One of the reasons third world countries have higher mortality rates is that their people don't have a balanced diet.

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There are also individual deficiencies such as a lack of vitamin C which results in scurvy.

Pre-existing disease. We have known for a long time that the existence of one disease tends to pave the way for another illness. Older people, for example, dying of a chronic, noninfectious disease will frequently develop bacterial bronchopneumonia. Diabetics are susceptible to many bacteria infections, and otherwise "mild" respiratory viral infections may pave the way for a severe bacterial disease.

Stress. Stress is another factor which influences disease occurrence by not allowing the body's defense system to function at its fullest. We all have been told by our mothers not to get wet and chilled or we will catch a cold. Chilling is a stress on the body which weakens our defense system, allowing a cold virus invasion into the body. Other literature suggests that stress may lead to active cases of tuberculosis or poliomyelitis in some people.

Exercises (026):

1. Explain how the physiologic state of an individual is important in disease occurrence.

2. What effect on the body does a grossly inadequate intake of nutrients have?

3. How does a pre-existing disease in the host affect his or her susceptibility to other disease agents?

4. What effect does any stress have on host defenses?

027. Describe forms of immunologic responses and their results in the body.

One other type of protective mechanism the body has is immunity or its immune response. This is an important factor involved in disease occurrence because it is the host's immunity that fights infection.

Immune Response System. Immunity and the immunologic response is inborn in humans. For example, the resistance a person has to disease-causing agents of lower animals such as canine distemper virus and canine infectious hepatitis. Lower animals also have a resistance to pathogens of humans (e.g., canine species to influenza virus and measles). This particular resistance, an inherent resistance, is called natural immunity. We will be speaking of natural immunity in another context in this volume. We will discuss immunity to many pathogens as acquired either naturally (as by infection) or artificially (as by vaccination).

The presence of an antigen in the human body activates the immune response system. These antigens are anything that the host recognizes as a foreign substance; i.e., something that should not be there. Antigens cause the formation of protective antibodies which give the body specific immunity to infection and disease. If the host produced the antibody then the immunity is called active; if produced by another host, it's called passive. Either type may be acquired by natural means (naturally acquired) or with human intervention (artifically acquired).

Naturally acquired active immunity is the immunity received from actually contracting the infection. In this case the antibody the body produces is exactly what is needed to "inactivate" that specific antigen. This type of immunity is usually long lasting. Naturally acquired passive immunity is the immunity passed from a mother to the newborn infant. Naturally acquired passive immunity provides significant protection for the child in the early months of life against many disease agents. These antibodies are usually short lived—i.e., they disappear by about 6 months of age. Artificially acquired active immunity is that produced by getting an immunization such as a vaccine (preparations containing all or some portion of the agent). The agent becomes an antigen in the body and causes the formation of antibodies. Some important vacines are those used against influenza, measles, poliomyelitis, etc. Just like naturally acquired passive immunity (mother to chile) there also is artifically acquired passive immunity in which the actual antibody itself is given and the human body is not required to produce any antibodies. The use of immune serum globulin (antibody for protection against hepatitis A) is an example of this type of immunity. Artifically acquired passive immunity is usually short lived.

Besides the individual protection, one of the reasons we vaccinate people is to create a high percentage of immunity in the entire population (or "Herd"). This is commonly referred to as "Herd Immunity." The more individuals who are immune to a specific disease the less chance that disease may spread to susceptible individuals within that population.

Exercises (027):

1. What type of immunity is it when the host produces the antibodies?

2. What type of immunity is acquired by human intervention?

3. What causes naturally acquired active immunity?

4. How is artificially acquired passive immunity provided?

5. Is artificially acquired passive immunity usually short or long lived?

028. State how the various aspects of human behavior influence exposure to disease agents and the way in which these agents are transmitted.

Human Behavior and Disease. Human behavior, individual practices, as well as customs of groups have a tremendous impact on exposure to disease agents and the manner in which they may be transmitted to others. The behavioral factors and the influences of the environment are often hard to distinguish since they often tend to influence each other. In this section, we will attempt to describe the impact human behavior has on disease transmission.

Diet. The diet of a population and how the food is handled and prepared often influence the health and disease patterns within the community. Diet was discussed earlier in this chapter. How food is prepared can also be another problem. In some countries, (Scandinavia and the Orient) food (i.e., pork, raw fish, etc.) is not cooked thoroughly, thus lending to such parasitic diseases as trichinosis and tapeworm.

In the past, "certified" (or raw) milk was sold in just about every state in the United States and, despite the care in handling it, was proven to be the source (vehicle) of many disease outbreaks (e.g., Q-fever, salmonellosis, and brucellosis). Pasteurization of the milk eliminated virtually all of these diseases via the milk. Recently, with the emphasis on natural foods, the tendency of certain states has been to allow the sale of raw milk again; thus, now we are seeing the resurgence of these diseases.

Water. Human behavior is very important in predicting diseases that may be transmitted through water. Our society determines not only the quality of the water but the form of the water we use. In the United States we try to prevent waterborne diseases by protecting water from contamination through filtration and chlorination. Some rural families still use water from wells and need to be educated as to precautions (boiling and/or chlorine tablets) necessary to assure the water is safe to drink. Also, some foreign countries may not have the means to filter and chlorinate the water.

Disposal of human wastes. The human behavior aspects of how human wastes are disposed of are very important in disease transmission. Improper disposal of wastes (such as frequently occurs in underdeveloped and poorly educated countries) attracts flies (vehicles for spreading enteric infectious agents). In addition to this, our drinking water may also be directly contaminated by human wastes, resulting in such diseases as hepatitis A, typhoid, and giardiasis. In some areas of the world, human feces (sometimes called night soil) is used for fertilizer on vegetables. This practice directly contaminates many food crops that are consumed raw (lettuce, potatoes, tomatoes, strawberries, etc.), thus allowing the transmission of such fecal diseases as typhoid, dysentery, amebiasis, and hepatitis A. Shellfish, clams, oysters, etc. may become contaminated if grown in sewage polluted water. In the past there have been major outbreaks of hepatitis directly traced to sewage contaminated shellfish. It was once said that the greatest invention to improve public health was the flush toilet.

Personal hygiene. Personal hygiene is one of the most important factors in the control of communicable disease. For example, an individual's hands are frequently contaminated during the day. If that individual is a foodhandler, contaminated hands could result in a foodborne outbreak from salmonella or staphylococcus. In a child care employee, it could result in the spread of hepatitis A or shigella. In fact, some research suggests that contaminated hands may be more of a contributing factor to the spread of upper respiratory disease than coughing and sneezing. In some people or cultures the individuals may not practice good bathing hygiene. This may lead to a lice infection, and lice can transmit diseases such as typhus. In fact, during World War II, the troops' clothing was sprayed regularly with DDT to kill the lice. These troops were unable to bath routinely. The degree of personal hygiene plays a very important role in disease distribution.

Personal contact. Personal contact includes handshaking, kissing, and sexual intercourse. We have already discussed hand spread diseases above. Kissing can result in the spread of infectious mononucleosis and cold sores (herpes virus). Intercourse and related activities may spread crab lice, herpes virus, and gonorrhea. Finally, almost all young children are very curious about each other and may be rather intimate with each other. This creates a good mode of transmission for hepatitis A, pinworms, numerous respiratory diseases, and poliovirus, just to name a few. Sanitary surveys and education of employees at child care centers are extremely important in preventing some of these diseases.

Household hygiene. The family health itself depends on the degree of sanitation and hygiene within the household. When the whole family sleeps in a single bed (as is common in certain cultures and impoverished families), contact agents and body lice can be spread. The types of pets present in the home and contact with them is important also. In each home, measures must be taken to protect against disease vectors (rodents, roaches, flies, etc.) as well as to assure good sanitation in the house and in foodhandling.

Occupation/recreation. The risk or acquiring certain diseases can in many cases be directly related to the occupation/recreation of the individual. Workers may be exposed to many toxins in their jobs (lead, mercury, asbestos, radioactive materials, etc.), which may have an adverse effect on the body. Even outdoor workers (construction workers, farmers, etc.) have an increased risk of developing skin cancer as a result of prolonged exposure to the sun; exposure to zoonotic diseases from contact with arthropod vectors; and, of course, in some cases serious accidents from the use of heavy machinery. Recreation in itself is good, but some of our recreational habits increase the chance of contracting a disease.

Travel takes us to many foreign areas where a wide variety of diseases may be endemic. Recreation activities may cause an increase in accident as well as expose us to unfriendly aspects of nature (i.e., poison ivy, oak, etc.) and certain disease vectors.

Other. Certain individual behavior within a society, such as over indulgence and addiction to alcohol, tobacco, and drugs, not only increases the chances of getting certain diseases (lung cancer) but makes the individual more susceptible to other infections (e.g., drug users and hepatitis B due to the use of contaminated needles).

Exercises (028):

1. State how the diet of a population influences disease transmission.

2. How do we try to "protect" our water supplies in the United States?

3. What are some ways personal contact is involved in disease transmission?

4. How might our occupation/recreation be important in disease transmission?

029. State how the physical, biological, and socioeconomic environments influence the spread of diseases.

Environmental considerations. For many years we thought we could explain why disease outbreaks occurred by studying the climate. Humidity, radiation (from the sun), and temperature are very important in the survival of many disease agents. Too much warmth, radiation, or excessive drying (from the environment) is usually deadly to many disease agents, one of which is the tuberculosis bacillus. Temperature and humidity are extremely important in the development of intestinal helminths (or worms). Roundworm eggs are very dependent on adequate humidity and warm temperatures in the soil to become infective. They also require a certain type of soil to survive. The multiplication and development of the malarial parasite (and of yellow fever) in its mosquito vector and, of course, the activity and breeding of the vectors are definitely favored by warm temperatures. But, we soon realized that even though the climate of the region was important in its impact on disease outbreaks, such things as the animals present in an area (potential vectors and reservoirs of disease) were recognized as equally important. The differing life styles of the city and rural environments also seemed to have an impact on the transmission of disease, as well as the types of diseases that were found in each place.

Physical environment. In talking about the physical environment, we will be referring to the impact that both climate and geography have on the occurrence of disease and its spread.

Climate. As stated previously the climate of an area is a key factor in the transmission of certain diseases. In colder months, respiratory diseases occur much more frequently. During this time, people are generally crowded indoors and our body's resistance is lower (remember, changes in temperature "stress" the body and increase susceptibility). Enteric infections tend to increase in the summer months. With warmer temperatures come more picnics and a greater chance for food spoilage. Hayfever sufferers also know the effect the climate may have on their condition since the amount of plant pollen in the air is determined in many cases by the climate. The presence of natural and fresh foods is also determined by the climate. Even the amount and type of shelter we would need to protect ourselves is determined by the climate. It is easy to see how these factors may have an impact on the resistance a population has to disease agents.

Geography. The occurrence of disease is also determined by the geography of an area. You can read in the Centers for Disease Control (CDC) morbidity/mortality reports how certain diseases seem to be restricted to certain areas. Part of the reason for this specific distribution is that these areas are where the reservoir/vector for the disease agent can survive.

At one time, we thought geographic factors were the only factors in determining disease spread. Distance and such geographic features as mountains and rivers act as natural barriers or as aids to disease spread. These components are less important in the United States, but they are still of importance in some of the developing countries where you may be assigned.

Lastly, of course, geography also influences the climate (by altitude, longitude, latitude, etc.) which in turn affects the biologic environment as well as certain aspects of human behavior. Warm climates provide suitable breeding and reproduction environments for many disease vectors, and the practice of wearing less clothes in the summertime increases our contact with them.

Biological environment. The biological environment includes all living things (animals, plants, bacteria, viruses, etc.). Adequate nutrition provided by this environment helps our body to resist many disease agents. Some of the plants, however, are "harmful" (poison ivy, toxic mushrooms and, to a hayfever sufferer, even plant pollens). On the other hand, some of this toxic plant life is beneficially used in medicine (quinine from a tree bark for treatment of malaria). As you can see, plant and animal life can directly have both "good" and "bad" effects on humans. In an indirect manner, this environment can also affect us and the spread of disease by providing homes and food for many disease vectors and reservoirs for disease. Some mosquitoes (*Aedes aegypti*) live only in tree holes. Small mammals may provide the needed food meal for mosquitoes (and fleas, ticks, etc.), thereby serving as a potential source of infection.

Socioeconomic environment. The evaluation of the influence the socioeconomic environment (cultural, political, and social developments) has on disease occurrence is often very hard because, even though we realize that this environment affects human's health, it is often hard to determine why. For instance, the closer a group of people are can definitely affect how easily diseases are spread. Where the population is located may cause differences in exposure to different types of pathogenic agents. An illustration of this can be seen in one community (city versus rural life). Think of the different styles of living (occupations, recreations, methods of waste disposal, etc.) and the different plants and animals (sources of infection) found in each area. Some people say that rural life is healthier than city life. This is not necessarily true. The number of cases of diseases occurring in the city and in the rural areas is not vastly different. However, you will see that the types of diseases that occur in each area may vary a lot because of different exposures.

Exercises (029):

1. What impact does the climate have on the transmission of certain diseases?

2. How does the geography of the land determine the distribution of disease?

3. Why is the biological environment important in disease occurrence?

4. Cite differences in urban and rural living and the impact they have on human's health.

3-6. Biostatistics

Would you be interested if we said that you had only about a 10 percent chance of passing this career development course? Or how about the chances are one in three that you will get a foodborne illness while you are stationed at your base? Whether we realize it or not, statistics play a large part in our lives—especially in the work that we do.

You have already used statistics in some of your food inspection activities. Remember MIL-STD 105-D? How do you suppose the accept and the reject numbers came about? Magic? How about the table of random numbers? In our food inspection use of statistics we learned that if you take a random sample of a given number of units, that sample will be representative of the entire lot within a certain percentage of accuracy. Then based on the statistical findings—i.e., the number of defects—we know we should either reject or accept the lot.

Statistics are in use in all areas of our lives. The Consumer Price Index (CPI), percent chance of rain, and advertising (e.g., dentists who recommend that their patients chew sugarless gum to reduce cavities) are only three examples of where statistics are used. As an environmental health specialist, you use statistics to help analyze disease incidence, to predict future disease trends, and to summarize data. Appendix B lists some of the statistics you will be maintaining.

Statistics may be defined as facts or data of a numerical kind, assembled, classified, and tabulated so as to present significant information about a given subject. Biostatistics is statistics concerning life. There are several ways these facts may be assembled, classified, and tabulated. One of the ways we may present this data is through the use of the measurements of central tendency.

030. Given a set of data calculate mean, mode, median, and range; then choose which one best measures the central tendency for that set of data.

Measurements of Central Tendency. The measurement of central tendency (or sometimes referred to as the "true average") which we choose to present our data should be the one that will most accurately portray the situation. Statistics can be misused in many ways, and we must ensure that the message we convey with our statistical data is in fact a correct one.

Arithmetic mean. As another means of describing a population or a sample, we now seek a few numbers which may in some sense summarize or describe a set of data. Such numbers, if they describe a population, are called parameters; if they describe a sample, they are called statistics.

The first number desirable gives the center of the distribution, in some sense, or the location of the distribution. Such a number is commonly called an average. The term average will usually be avoided in this section because there are so many types of average that a specific term is useful. At any rate, the first number that will be sought to describe a set of data will be some sort of average.

The number most commonly used for this purpose is called the arithmetic mean or simply the mean. The arithmetic mean for a sample is defined as the sum of all the observations divided by the number of observations (i.e., an average).

Example

You are asked to give an average concentration of the fluoride in the drinking water to the base dental surgeon.

Monthly results: 1.0 mg/l, 1.2 mg/l, 0.8 mg/l, 1.0 mg/l.
Step 1 – Add all the values of the data.

Step 2 – Count the number of items.
Step 3 – Divide the sum of the numbers by the number of items.

Solution:

Arithmetic mean is 8.0 divided by 8 or 1.0 mg/l.

Mode. One other type of number used to describe the center of a distribution is the mode. The mode is the number occurring most often in a group of set of numbers.

Example

Problem #1 6, 9, 12, 15, 12, 92, 36. (The mode is 12 because there are two twelves and only one of each other number.)
Problem #2 2, 2, 4, 6, 6, 2, 6, 22 (The modes are 2 and 6. This set of data has two modes and is called bimodal.)
Problem #3 8, 9, 16, 12, 15, 7, 15 (The mode is 15).

Median. Another number or measurement of central tendency is the median. The median of a set of data (be it sample or a given population) is the middle number in a group of numbers when the number of observations is odd. On the other hand, when the number of observations is even, the median is the arithmetic mean of the two middle numbers in the array.

Example
17, 5, 9, 6, 2, 10

Step 1 – Array the data from the smallest to the largest number: 2, 5, 6, 9, 10, 17.
Step 2 – Count the number of items – 6.
Step 3 – Choose the middle values – third and fourth items.
Step 4 – Average the middle values – 6 + 9 = 15; 15/2 = 7.5.
Step 5 – Solution – The median in the above array of numbers is 7.5.

Remember if there is an odd number of items, then there will be a middle number. If there is an even number of items in an array of data or set of numbers than we must average the two middle numbers to make a middle value. Don't forget the first thing you must do in determining what is the middle value is to arrange the data from smallest to largest number.

For many populations that are approximately symmetric, the median and mean are very close together, so that it makes little difference which we wish to find. If the distribution of the population is highly skewed (i.e., some of the data is vastly different from the rest), the mean and median may be quite different. For example: 8, 5, 4, 6, 7, 5, 4, 5, 100, 90.

When the population is skewed we should consider whether we wish to find the median or the mean. Incomes usually have a rather skewed distribution. A few very large incomes may make the mean income much higher than what might be considered usual income, so that perhaps the median income might be of more use to a student of sociology than the mean income.

The choice of which one to study depends on the point of view. For example, suppose the population consists of the amounts of milk consumed per day by the inhabitants of a certain community. A nutritional worker might wish to know the median; then he or she could make some statement such as that half the people consume less than 1½ glasses of milk per day, and this would give some indication of the dietary habits of the community. The manager of the dairy supplying the community with milk would probably be more concerned with the arithmetic mean, since from the arithmetic mean a person can compute the total amount that must be supplied per day.

The arithmetic mean is generally preferred to the median, other things being equal, because it is more stable under sampling; it varies less from one sample to the next. However, if given the choice of what you should do when measuring central tendency, the *BEST* thing to do (if time permits) is to use all the characterizations (i.e., mean, mode, median, and range which we will discuss next). After all, an accurate picture of the situation is what you are striving for with your analysis of the statistical information.

Range. This is simply the lowest and highest number in your data. You already are using range when you accomplish net weight examinations. Range may be expressed as a single number or as the highest and lowest number.

Example

Performing a net weight examination you get the following results: +3, –2, –4, +1, +½, –½.

Range =

–4 to +3 lbs. (7 as a single number)

Exercises (E30):

1. Define statistics.

2. For the aerospace medicine report you are asked to report the average coliform density of your aircraft water examinations. Your results are as follows: colonies per 100 ml: 0, 0, 3, 6, 0, 0, 3, 6, 9, 11, 2, 0, 60). Calculate the mean, mode, median, and range.
   a. Mean ____________
   b. Mode ____________
   c. Median ____________
   d. Range ____________

3. Work exercise 2 again using 5000 as a bacterial result instead of 60.
   a. Mean ____________
   b. Mode ____________
   c. Median ____________
   d. Range ____________

4. Refer to exercises 2 and 3 results. In each case, which one of these measures central tendency the best for each set of data?

024. Calculate noneffectiveness rate, incidence rate, hospital admission rate, and attack rate.

Rates and Ratios. Another tool that helps us observe disease trends is the use of rates and ratios. Rates and ratios not only allow us to monitor disease outbreaks but with these tools you can also predict future disease trends and their possible impact on the Air Force mission.

Rates are some of the most important statistical tools of the Environmental Health Service. Rates are more than a list of numbers. They are based on constants, such as the number of personnel and a certain period of time. They give meaningful statistics even as the base population varies. A rate measures the probability of occurrence of some particular event.

Thus

$$\text{Rate} = X/Y \times K$$

Where

X = number of times an event has occurred during a specific interval of time.
Y = number of persons exposed to the risk of the event during the same interval.
K = some round number (100, 1000, 10,000, 100,000 etc.) depending upon the relative magnitude of X and Y.

Compare 50 STD cases at a base with a population of 500 to a base which has a population of 5000. A constant population allows us to compare one base or area to another (100/1000 compared to 10/1000 if K equals 1000).

A ratio is the expression of the relationship between a numerator and denominator which may involve either an interval in time or may be instantaneous in time.

Thus

$$\text{Ratio} = X/Y \times K$$

Where

X = number of events or items counted not necessarily a portion of Y.
Y = number of events or items counted not necessarily a population of persons exposed to the risk.
K = a base as in the case of a rate but usually 1 or 100 for the purpose of expressing ratios.

Noneffectiveness rate (NER), incidence rate (IR), hospital admission rate (HAR), and attack rate (AR) are some of the rates and ratios in common use in monitoring disease trends; i.e., biostatistics.

Sources of data. Patient affairs is one of your main sources of data for monitoring disease trends with biostatistics. The AF Form 570, Notification of Patient's Medical Status, is filled out by each health care provider. A locally approved form may also be used to notify you of communicable diseases. The key here is that a notification system is set up. It is from these forms that you get some of the needed information for compiling certain rates. The doctor (or his equivalent) makes the diagnosis. You may have to determine if that condition is one that you should keep track of at your base. This is not an easy job. Example: You are screening the AF Forms 570 for the month of March and you have recorded such diseases/conditions as common cold, acute rhinitis, pneumonia (organism unspecified), and sore throat. The rate you are calculating is incidence rate for upper respiratory infections (URI's) for your base. Are these all URI's? The ICD-9 (International Communicable Disease) codes (fig. 3-2) will help you determine appropriate disease grouping. Using these codes you see that common cold (460), acute rhinitis (460), and sore throat (462) are URI's. Pneumonia (486) is not considered an upper respiratory infection. Refer to the ICD codes in figure 12-9 of AFR 168-4, *Administration of Medical Activities,* (fig. 3-3). The URI range is 46000–46610; and therefore the case of pneumonia would not be counted in the total number of URI's for the month of March. The book containing these codes should be located in your patient affairs office.

Noneffectiveness rate (NER). The noneffectiveness rate is the most important statistical information needed for communicable disease programs. Noneffectiveness refers to the temporary loss of manpower from duty. A noneffective rate is a daily rate that indicates the number of people not physically or mentally fit for duty. It indicates the operating or treating load placed upon the medical service. It represents the number of people sick in hospitals or in quarters per 1000 strength for the day on which it is calculated; or it may be calculated over a number of days to determine the average daily noneffective rate.

This formula is used to compute the noneffectiveness rate:

NER per 1000 per day =

$$\frac{\text{Total man-days lost in period} \times 1000}{\text{Average strength} \times \text{number of days in period}}$$

Explanation: A man-day lost is the same as a patient day in the hospital. For example, 1 person in the hospital for 1 day represents 1 man-day lost; 2 people sick in quarters and 2 people sick in the hospital for 2 days is 8 man-days lost. The total man-days lost may be obtained from the weekly statistical report or may be developed by totaling the number of people sick in the hospital and quarters daily for the period under consideration. Days lost following transfer to another medical facility and days lost on convalescent leave should also be included. (The average strength figure may be obtained from patient affairs section or from the section they have to obtain it from: central base personnel office (CBPO), manpower section.)

Example:

Substitute the following values in the formula to obtain noneffective rate:

Frequency of the event being considered: 21 sick people
Population involved: 840 average strength
Period of time involved: 1 day

$$\frac{21 \times 1000}{840 \times 1} = \frac{21{,}000}{840} = 25 \text{ (noneffective rate per 1000 per day)}$$

ACUTE RESPIRATORY INFECTIONS (460-466)

Excludes: *pneumonia and influenza (480.0-487.8)*

460 Acute nasopharyngitis [common cold]

Coryza (acute)
Nasal catarrh, acute
Nasopharyngitis:
  NOS
  acute
  infective NOS

Rhinitis:
  acute
  infective

Excludes: *nasopharyngitis, chronic (472.2)*
pharyngitis:
  acute or unspecified (462)
  chronic (472.1)
rhinitis:
  allergic (477.0-477.9)
  chronic or unspecified (472.0)
sore throat:
  acute or unspecified (462)
  chronic (472.1)

461 Acute sinusitis

Includes: abscess, empyema, infection, inflammation, suppuration } acute, of sinus (accessory) (nasal)

Excludes: *chronic or unspecified sinusitis (473.0-473.9)*

461.0 Maxillary

Acute antritis

461.1 Frontal

Figure 3-2. ICD-9 codes (international communicable disease).

461.2 Ethmoidal

461.3 Sphenoidal

461.8 Other acute sinusitis
Acute pansinusitis

461.9 Acute sinusitis, unspecified
Acute sinusitis NOS

462 Acute pharyngitis
Acute sore throat NOS
Pharyngitis (acute):
  NOS
  gangrenous
  infective
  phlegmonous
  pneumococcal
Pharyngitis (acute):
  staphylococcal
  suppurative
  ulcerative
Sore throat (viral) NOS
Viral pharyngitis

Excludes: *abscess:*
  peritonsillar [quinsy] (475)
  pharyngeal NOS (478.29)
  retropharyngeal (478.24)
chronic pharyngitis (472.1)
infectious mononucleosis (075)
that specified as (due to):
  Coxsackie (virus) (074.0)
  gonococcus (098.6)
  herpes simplex (054.79)
  influenza (487.1)
  septic (034.0)
  streptococcal (034.0)

Figure 3-2. ICD-9 codes (international communicable disease) (Cont'd).

485 Bronchopneumonia, organism unspecified

Bronchopneumonia:
  hemorrhagic
  terminal
Pleurobronchopneumonia
Pneumonia:
  lobular
  segmental

Excludes: *bronchiolitis (acute) (466.1)*
  chronic (491.8)
lipoid pneumonia (507.1)

486 Pneumonia, organism unspecified

Excludes: *hypostatic or passive pneumonia (514)*
influenza with pneumonia, any form (487.0)
inhalation or aspiration pneumonia due to foreign materials (507.0-507.8)
pneumonitis due to fumes and vapors (506.0)

487 Influenza

Excludes: *Hemophilus influenzae [H. influenzae]:*
  infection NOS (041.5)
  laryngitis (464.0)
  meningitis (320.0)
  pneumonia (482.2)

487.0 With pneumonia

Influenza with pneumonia, any form
Influenzal:
  bronchopneumonia
  pneumonia

487.1 With other respiratory manifestations

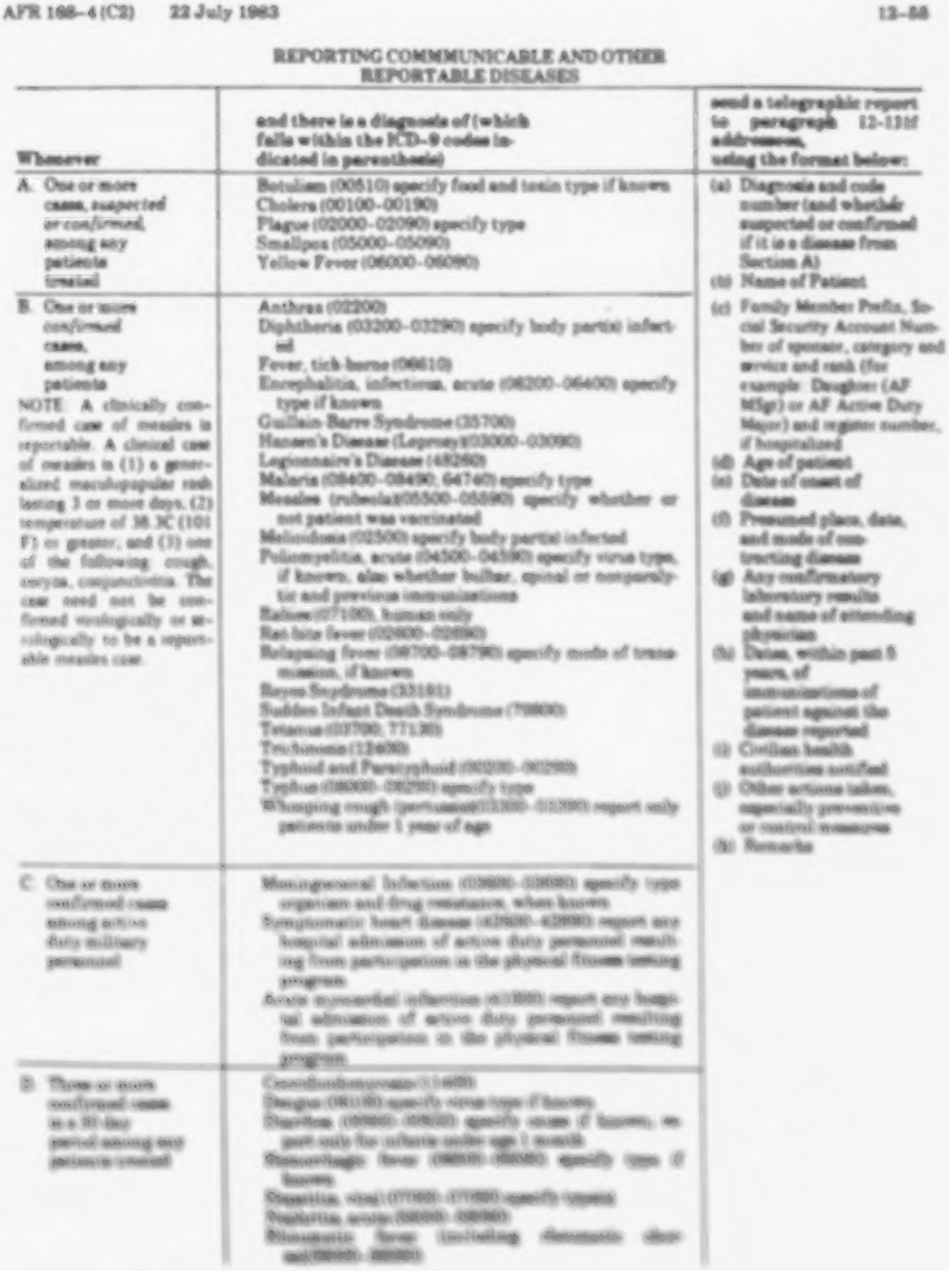
Influenza NOS
Influenzal:
  laryngitis
  pharyngitis
  respiratory infection (upper) (acute)

487.8 With other manifestations

Encephalopathy due to influenza
Influenza with involvement of gastrointestinal tract

Excludes: *"intestinal flu" [viral gastroenteritis] (008.8)*

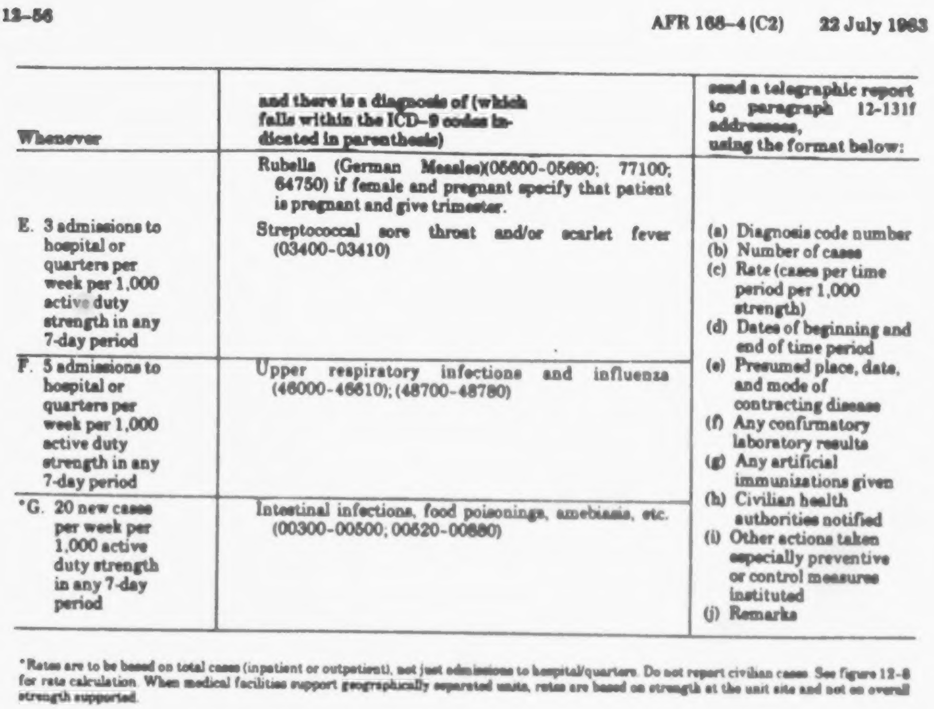
Figure 3-2. ICD-9 codes (international communicable disease) (Cont'd).



REPORTING COMMMUNICABLE AND OTHER REPORTABLE DISEASES

Whenever	and there is a diagnosis of (which falls within the ICD-9 codes indicated in parenthesis)	send a telegraphic report to paragraph 12-13f addressees, using the format below:
A. One or more cases, *suspected or confirmed*, among any patients treated	Botulism (00510) specify food and toxin type if known Cholera (00100-00190) Plague (02000-02090) specify type Smallpox (05000-05090) Yellow Fever (06000-06090)	(a) Diagnosis and code number (and whether suspected or confirmed if it is a disease from Section A) (b) Name of Patient (c) Family Member Prefix, Social Security Account Number of sponsor, category and service and rank (for example: Daughter (AF MSgt) or AF Active Duty Major) and register number, if hospitalized (d) Age of patient (e) Date of onset of disease (f) Presumed place, date, and mode of contracting disease (g) Any confirmatory laboratory results and name of attending physician (h) Dates, within past 5 years, of immunizations of patient against the disease reported (i) Civilian health authorities notified (j) Other actions taken, especially preventive or control measures (k) Remarks
B. One or more *confirmed* cases, among any patients NOTE: A clinically confirmed case of measles is reportable. A clinical case of measles is (1) a generalized maculopapular rash lasting 3 or more days, (2) temperature of 38.3C (101 F) or greater; and (3) one of the following: cough, coryza, conjunctivitis. The case need not be confirmed virologically or serologically to be a reportable measles case.	Anthrax (02200) Diphtheria (03200-03290) specify body part(s) infected Fever, tick-borne (06610) Encephalitis, infectious, acute (06200-06400) specify type if known Guillain-Barre Syndrome (35700) Hansen's Disease (Leprosy)(03000-03090) Legionnaire's Disease (48280) Malaria (08400-08490, 64740) specify type Measles (rubeola)(05500-05590) specify whether or not patient was vaccinated Melioidosis (02500) specify body part(s) infected Poliomyelitis, acute (04500-04590) specify virus type, if known; also whether bulbar, spinal or nonparalytic and previous immunizations Rabies (07100), human only Rat-bite fever (02600-02690) Relapsing fever (08700-08790) specify mode of transmission, if known Reyes Syndrome (33181) Sudden Infant Death Syndrome (79800) Tetanus (03700, 77130) Trichinosis (12400) Typhoid and Paratyphoid (00200-00290) Typhus ([illegible]) specify type Whooping cough (pertussis)([illegible]) report only patients under 1 year of age	
C. One or more confirmed cases among active duty military personnel	Meningococcal Infection ([illegible]) specify type organism and drug resistance, when known Symptomatic heart disease ([illegible]) report any hospital admission of active duty personnel resulting from participation in the physical fitness testing program Acute myocardial infarction ([illegible]) report any hospital admission of active duty personnel resulting from participation in the physical fitness testing program	
D. Three or more confirmed cases in a 30 day period among any patients treated	[illegible] ([illegible]) Dengue ([illegible]) specify virus type if known Diarrhea ([illegible]) specify cause if known; report only for infants under age 1 month Hemorrhagic fever ([illegible]) specify type if known Hepatitis, viral ([illegible]) specify type(s) Nephritis, acute ([illegible]) Rheumatic fever (including rheumatic disease)([illegible])	

Figure 3.5. AFR 168-4, figure 12-9, reporting communicable and other reported diseases.



12-56 AFR 168-4 (C2) 22 July 1983

Whenever	**and there is a diagnosis of (which falls within the ICD-9 codes indicated in parenthesis)**	**send a telegraphic report to paragraph 12-131f addressees, using the format below:**
E. 3 admissions to hospital or quarters per week per 1,000 active duty strength in any 7-day period	Rubella (German Measles)(05600-05690; 77100; 64750) if female and pregnant specify that patient is pregnant and give trimester. Streptococcal sore throat and/or scarlet fever (03400-03410)	(a) Diagnosis code number (b) Number of cases (c) Rate (cases per time period per 1,000 strength) (d) Dates of beginning and end of time period (e) Presumed place, date, and mode of contracting disease (f) Any confirmatory laboratory results (g) Any artificial immunizations given (h) Civilian health authorities notified (i) Other actions taken especially preventive or control measures instituted (j) Remarks
F. 5 admissions to hospital or quarters per week per 1,000 active duty strength in any 7-day period	Upper respiratory infections and influenza (46000-46610); (48700-48780)	
*G. 20 new cases per week per 1,000 active duty strength in any 7-day period	Intestinal infections, food poisonings, amebiasis, etc. (00300-00500; 00520-00880)	

*Rates are to be based on total cases (inpatient or outpatient), not just admissions to hospital/quarters. Do not report civilian cases. See figure 12-8 for rate calculation. When medical facilities support geographically separated units, rates are based on strength at the unit site and not on overall strength supported.

Figure 3-3. AFR 168-4, figure 12-9; reporting communicable and other reported diseases (Cont'd).

Example 2:

Frequency of the event being considered:

1st day	8 people sick
2nd day	10 people sick
3rd day	7 people sick
4th day	5 people sick
5th day	5 people sick
6th day	7 people sick
7th day	10 people sick
Total for 7 days	52 people sick

Population involved: 1600 average strength. Period during which frequency occurred: 7 days

$$\frac{52 \times 1000}{7 \times 1600} = \frac{52{,}000}{11{,}200} = 4.6 \text{ (noneffective rate per 1000 per day)}$$

Incidence Rate (IR): Some diseases are not serious enough to require hospitalization resulting in days lost. However, diseases of this nature may occur often enough to be important to the Air Force because of the cost of treating them, the enormous number of hours of outpatient services they make necessary, and the loss of efficiency they cause on the job.

The incidence rate is a measure that indicates the frequency of new cases of a particular disease or group of diseases that occur in a population during a given period of time. The *annual incidence rate* of a disease or condition is normally calculated as follows:

$$\text{Incidence Rate} = \frac{\text{Number of cases in a given year} \times 1000}{\text{Population (annual average)}}$$

When the incidence is known for a *period of less than a year*, the *annual rate* may be *computed* by using this formula:

Incidence Rate =

$$\frac{\text{Number of cases during a period in a year} \times 1000 \times \text{Number of such periods in a year}}{\text{Average daily strength during the period}}$$

Example 1:

During the month of June at Brooks AFB there were the following mosquitoborne diseases: 16 cases of malaria, 12 cases of yellow fever, and 10 cases of dengue fever. Calculate the incident rate (per 1000 × population per year) for mosquitoborne diseases. The average daily population was 3,500.

Incidence Rate =

$$\frac{\#\text{ of cases in period} \times 1000 \times \#\text{ of periods in a year}}{\text{Average daily strength in period}}$$

16 cases malaria
12 cases yellow fever
10 cases dengue
38 cases

$$\frac{38 \times 1000 \times 12}{3{,}500} = \frac{456{,}000}{3{,}500}$$

Incidence Rate (IR) = 130.2857 or 130.3/1000 pop/yr.

Example 2:

At anywhere AFB the following information was obtained from the EHS for URI's. The mean daily strength for the period was 3200. Calculate the IR/1000/year.

Jan =	45
Feb =	64
Mar =	122
Apr =	96
Total -	327 cases

Solution:

$$\frac{327 \times 1000 \times 3^{*}}{3{,}200 \text{ (average of base strength in 4 months)}}$$

$= 306.6$ cases/1000/year

*Note: The 3 is number of periods in a year. In this case there are three 4-month periods in a year.

Hospital admission rate (HAR). This rate is very similar to the incidence rate except that the number of cases is replaced by the number of admissions. Hospital admission rate may be described as the rate calculated for the number of personnel admitted to the medical facility during a specific period (daily, weekly, monthly). This rate can be for all causes or for a specific cause such as for URI's The formula for calculating the hospital admission rate is as follows:

$$\frac{\text{\# of admissions in period} \times 1000 \times \text{\# of periods in a (week, month, etc.)}}{\text{Mean strength period}}$$

Attack rate (AR). Attack rate may be defined as a rate used to determine suspect food, source of disease, or infection. This may be used in food, water, vector, or airborne epidemic investigations such as an outbreak of hepatitis A. In attack rates two groups or populations are compared—those ill and those not ill (sometimes referred to as the "control group"). After calculations are performed the greatest difference in percentages is the suspect or cause of the infection. The formula for attack rates is:

$$\frac{\text{Number ill} \times 100}{\text{Total population at risk}} = \text{\% ill}$$

Example:

Recently at nowhere AFB, the EHS section had their annual fish fry. Several people at this event were stricken with an unknown foodborne illness 6 hours later. From the following information calculate the attack rate and state what food would be suspect.

Food	*No. Eat*	*No. Sick*	*AR*
a. Bugle mouth bass	15	4	—
b. Potato salad	18	9	—
c. Bean salad	20	17	—
d. Macaroni salad	15	15	—
e. Hush puppies	12	6	—

Solutions for attack rate

a. $\frac{4 \times 100}{15} = 26.7\%$

b. $\frac{9 \times 100}{18} = 50.0\%$

c. $\frac{17 \times 100}{20} = 85.0\%$

d. $\frac{15 \times 100}{15} = 100.\%$

e. $\frac{6 \times 100}{12} = 50.\%$

In this example it appears the "suspect" food is the macaroni salad.

Exercises (031):

1. Where can you obtain information needed to calculate NER, IR, and HAR?

2. Calculate NER's for the following data:

	a.	*b.*
Total man-days lost in period	45	38
Mean average strength for the period	1200	2400
Days in period	7	30

Answer a. __man-days lost/1000 pop/day
b. __man-days lost/1000 pop/day

3. Compute IR's for the following:

	a.	*b.*
Annual average population	5,200	4,200
number of cases per year	36	48

Answer a. __/1000 pop/yr.
b. __/1000 pop/yr.

4. Compute the annual IR for the following: (Remember; IR can be a "predictive rate," so don't forget the multiplier i.e., determine how many 1 month periods there are in a year.)
Population: 4,200
Number of cases: 14 cases of gonorrhea occurring within 1 month.

3-5. Epidemiological Investigations

You have already learned from previous courses and experience that in any disease outbreak, three things must be available: (1) a source of infection, (2) a method of spread or transmission, and (3) a susceptible host. These three links make up what is known as the chain of infection. Using the old adage that a chain is only as strong as its weakest link, your aim is to locate and break the weakest link, thereby eliminating the spread and containing the disease. Many references will be made to the chain of infection. This is the basic principle against which most of our efforts are directed in environmental health.

Upon completion of the section, you should know the principles that govern an epidemiological investigation. You will learn various methods of investigation from which you can choose according to a given situation. You will review some of the information learned during your study in becoming a 3-level specialist, and expand upon it. You will be given information to enable you to initiate, perform, and follow up an epidemiological study of any of the epidemic or communicable diseases with which you may come in contact.

032. Identify the study methods for conducting epidemiological investigations.

Study Method. In order to determine the reason for a disease being present, whether endemic or epidemic, various study methods can be used. These methods can be broadly classified as experimental or observational.

Experimental method. This method is far more accurate than the observational method, but the latter is by far the most used. Ethics do not permit indiscriminate disease experimentation on human populations. For this reason, the experimental method is usually performed on small groups of individuals or animals. Observations, on the other hand, can be carried out easier on larger numbers of individuals or communities that the observer desires to study. An example of the experimental method would be gathering two groups of equally susceptible people, matched by age, sex, and other factors; administering a vaccine, special diet, or other factor to one group; and withholding the factor from the other. By observing the results, a determination can be made of the effect or lack of effect of the added factor. No experiment is valid without the control group from which the factor is withheld. For example, suppose we take 50 basic military trainees and divide them into two groups of 25 each. The first group will be the control group. The control group will be allowed to eat only three meals a day in the dining hall. The second group, the experimental group, will be allowed to consume liquids only, such as fruit juices, milk, and water. The experiment will last for the 6 weeks of basic training. All 50 students will be weighed daily. Do you think the average weight of the experimental group will go up or down in comparison with the control group?

Observational method. By contrast with the experimental method, observational methods involve studying different groups under natural conditions. In this method, nature provides the experiment; you only observe, record, and state the result. There are two types of observation—controlled and uncontrolled.

Conducting a study using two populations or communities that are similar except for the factor under study is a controlled observation. A case-control study is one example in which a control group not having the disease is chosen for certain characteristics (age, sex, race, etc.), and matched to the cases under study. The control is the individual or group used as a standard. The actions or results of the other individual or group are compared to the control. An example of a controlled or case-control study is selecting 10 people who have a diagnosis of lung cancer and then selecting 10 people with regard to age, sex, race, occupation, etc. who don't have lung cancer. The lung cancer patients are your case group and the healthy people are your control group. Next you would look for differences in the group such as diet, amount of cigarettes smoked per day, and previous illnesses.

Uncontrolled observation would include studies where there are no explicit controls (i.e., same sex, race, age, etc.) but a judgment is made as to whether or not the cases were different from the rest of the population from which the cases came. Although probably the least accurate as a general rule, this is the most readily available and quickest of the methods. This is the method usually used to trace the source of food poisoning outbreaks, serious epidemics, sexually transmitted disease incidence and prevalence, etc. For instance, 300 people ate at a church picnic and 75 of those people developed a foodborne illness. You will compare what foods the 75 ate with the foods the other 225 ate. However, the 225 are not matched for age, sex, race, etc.

Variations in Study Design. Regardless of the method chosen for your epidemiological study, various designs exist from which to choose in setting up your survey. You should strive to analyze only one factor at a time in statistical work. Interpretation of results is easier to understand and less objection will be raised to your choice of study design. We will discuss the following three study designs—prospective, retrospective, and cross-sectional survey.

Prospective (looking into the future). This is a plan of study in which a group is brought under observation. They are classified according to characteristics, such as age, sex, and race. They are then divided into two groups, one having a factor believed to contribute to the condition and the other without the factor. They are then observed sufficiently to identify those who develop the condition or disease under study. This type of study is usually spread over an extended period of months or years, with the unknown element always being the chance that none of the chosen individuals will develop the condition under study. This type of study is appropriate for determining the attack rate per unit of time and per number of people for a given disease.

Retrospective (looking back). This is, for all practical purposes, the same as the case-control method previously described if controls are used. In this design, case studies of persons who already have the disease are studied. If possible, parallel persons free from the disease are studied and compared. Advantages of this design are ability to study rare diseases, ability to draw immediate conclusions, and less chance of the subject's leaving the jurisdiction of the observer.

Cross-sectional survey. This is simply observing, questioning, and studying relative proportions of a population in order to detect cases of a disease. Laboratory screening procedures and complete diagnostic evaluation of diseases of suspects are used. Simple items of information (age, sex, race, occupation, etc.) should be taken on all persons interviewed, including those who do not have the disease. In this way, simple prevalence ratios can be developed to show the correlation of any of these factors to the frequency of the disease.

Exercises (032):

1. When nature provides the data for your investigation and you only observe, record, and state the result, what method are you using?

2. Generally, which method of study is used to trace the source of food poisoning outbreaks?

3. Administering a vaccine or special duty to one group and withholding it from another to determine its effect is an example of what kind of method?

4. When case studies of people who already have the disease are studied, what type of study design is being used?

5. Observing, questioning, and studying relative proportions of a population in order to detect cases of a disease is what method of study?

033. State steps necessary for performing an epidemiological investigation.

Epidemic Investigation Procedure. Now that you have been introduced to a variety of study methods, you can choose the one best suited to your particular problem and begin your observations. As with practically any job, the best place to start is with a plan. Why waste time and confuse the issue with a lot of useless information? So first of all, let's plan the collection of data. State the problem or questions then decide what you wish to learn from the study and the relationship of the information to the problem. If you want to show a relationship between potato salad consumption and food poisoning, you do not need to record the depth perception or reaction time of the individual. In contrast, you certainly would want to record the number of persons eating the salad and the confirmed number of food poisoning cases that had eaten the salad. (How to conduct a food poisoning outbreak will be discussed later in your career development course.

Establish the existence of a epidemic. In this step (your "first" step) verification of the diagnosis that was made is essential. This can be done by encouraging fast reporting of cases by the medical agency, assuring reports that you receive are from good sources, and ensuring that you have both laboratory as well as clinical confirmation of the diagnosis. At this time you need to define the group involved and compare the incidence rate with the "norm". Ask yourself, "how significant is this departure from the normal disease rate (or amount)?" Are five cases of hepatitis in November the beginning of an epidemic or were there three to eight cases of hepatitis every November for the last 3 years?

Orient epidemic to time, place, and person. Orient the epidemic as to time, place, and person by determining a chronological distribution of the onsets of the cases (by days, weeks, months, etc.) Next, you must determine the place where the epidemic occurred. You will need to develop a geographic distribution of the area affected. Two methods often used to display this data are maps and graphs. Maps are normally used to illustrate an area of a base, city, etc., in which a problem or item of interest exists. Insect and rodent populations and/or breeding points are often shown on a base map. Noise hazard areas or industrial problem areas can also be outlined in this manner. Graphs are a very common form of diagramming and visual display. This is a simple form of showing disease rates or trends, noneffectiveness rate lines, bars, etc.

Distribution of parts of a whole is easily shown by the use of the "pie diagram." Two types of related graphs are commonly used in presenting statistical data—the simple line graph and the bar graph.

At this point you will want to get an initial idea as to the type of outbreak you are investigating (i.e., is it a person to person outbreak or a disease object involving a common vehicle). Determine also, whether a group of people was infected at or about the same time and, upon the basis of the incubation period of the disease in question, you will be able to fix the probable time it happened.

Next, you should make a rapid preliminary analysis of available information on the population and the reported cases and deaths, according to race, sex, age, occupation, and residence to discover what group or groups have been selected for attack. At this time you should formulate tentative hypotheses of what you think may be the most probably source(s) of infection. You will use this basis for your investigation.

Draw up plans for control. Now, initiate plans for:

a. Administrative measures to care for the sick and prevent the spread of the disease;

b. A detailed investigation of all cases or an unbiased sample of the cases;

c. Any special investigations that may be needed to investigate other potential problems of the outbreak (such as special laboratory help, engineering, and other expert consultation).

Analyze data. Now that you have stated the problem, collected most of the pertinent facts, tabulated or charted the data, and controlled the current situation, it is time to solve the problem of why it occurred and take steps to prevent it from happening again. Analyzing the data collected (and sometimes you must get more information) should answer why the outbreak occurred or at least point out the causative agent (source of infection).

Be sure to analyze the detailed data from your case investigation as soon as it can be assembled, comparing the attack rates found among many various pertinent groupings. Try to identify the group selected for the attack and discover the common source or sources to which the members were exposed. You must do individual epidemiologic histories to group exposed persons as to whether there was exposure to the potential vehicles; did they get ill; and if they did get ill were there medical lab tests to confirm the diagnosis that was made. You need to check the source and method of preparation and preservation of all of the suspected foods (in the case of a foodborne outbreak). Check the environmental conditions—e.g., the sanitary conditions in the local restaurants, water and milk supplies, and the examination of food that may be left after the epidemic. Be sure to show any significant variations of incidence of this disease in any of the other population groups within the area. This is done by showing in the section of the area and group concerned (city wards, sanitary districts) the attack rates by civil subdivisions from available population statistics and the comparative attack rates in racial, sex, age, and occupational groups. From more detailed records be sure to show attack rates in groups according to the sources of water and milk supplies; ice cream supply; character of residences and any other events or habits that seem to be important to the outbreak, etc. Remember, attack rates should be calculated for those exposed and those not exposed to each suspected vehicle, or the reverse could be calculated (i.e., the frequency of exposure to the suspected vehicle, among those attacked and those not attacked). Make sure you put together the results of those other studies too (e.g., the investigation of the water supplies) Lastly, you must search for the source of the infection. If you are able to locate the source you may be able to "break" the chain of infection and keep the outbreak from occurring again.

Test hypotheses. Test the various hypotheses ("an educated guess") that were suggested by your investigation or those you had tentatively made to ascertain which one is consistent with all of the known facts. Remember, there may be more than one of the hypotheses you made which will fit all of the known facts. You must then seek more facts until an array is found which matches all deductions from one hypothesis and does not match the rest. Make sure you base your conclusions upon all of the pertinent evidence, not just relying upon any one distribution or circumstance by itself.

Prepare final report. Lastly, it's time to put together the final report recommending measures to control or prevent any future epidemics of this kind. In the study of an epidemic it is important not only that you (the investigator) come to define and correct conclusions but also that you put together the facts and present them is such way as to establish these same conclusions in the minds of others—those who may have the influence and ability to control the problem. Very often it will be necessary for you to change your presentation to meet the understanding of persons who may lack the technical knowledge of epidemiology that you have.

Exercises (033):

1. What is your first step in studying any epidemic?

2. How do you determine that an increase in incidence of disease in an epidemic and not merely an outbreak?

3. How do you orient an epidemic to people?

4. What should plans for control of an epidemic include?

5. When testing your hypotheses, what is important to remember?

3-6. Disease Reporting

Many communicable diseases require reporting at the time of patient admission or as soon as such diseases are suspected. In some cases, even a suspected diagnosis should be reported as soon as possible to avoid delays while waiting laboratory confirmation. Examples of diseases requiring rapid case reporting are those which are universally required by *International Health Regulations:* cholera, yellow fever, and plague.

034. City procedures and responsibilities for communicable disease reporting.

USAF Reportable Diseases. It is the responsibility of the Environmental Health Service (EHS) to find out which diseases are to be reported under federal, state, and local laws. You must prepare a list of those diseases required by law and Air Force directives. If the disease is reportable only to civilian authority, it should be identified with one asterisk (*). If it is reportable only to Air Force authorities, identify it with two asterisks (**). All other diseases should be reported to both authorities. EHS has the responsibility of assuring that a copy of the list of reportable diseases is sent to each health care provider and other medical personnel responsible for diagnosing and reporting diseases. It should be noted that at those facilities which do not have an environmental health nurse or officer assigned, it is the responsibility of the Director of Patient Affairs to assist EHS is the preparation and distribution of the list.

Reporting Procedure. The Director of Base Medical Services (DBMS) is responsible for making communicable disease reports available promptly and directly to the responsible civilian agency, for and with the approval of the Base Commander. Anytime these reports may adversely impact security or security regulations, the civilian authorities should be bypassed and the report should be sent to the next higher Air Force headquarters for action. Additionally, you must ensure that all required diseases are being identified by health care providers. Your procedures and forms for accomplishing this should be adopted to meet the reporting requirements of the local and state health departments as well as Air Force requirements. Update your reportable disease list as necessary, at least annually as required by AFR 168–4, *Administration of Medical Activities.*

Keep a record of your report when the number of cases or the rates cited in figure 3-4 occur. To ensure that your reports are complete, you (and Patient Affairs) need to be informed each time a case of a listed disease is diagnosed. This notification would also include outpatients, inpatients with diseases suspected or confirmed on admission, any diagnosis changes that occur during hospitalization, or diseases that are being reported for the first time when the patient is discharged.

Action by Health Care Providers. A health care provider making a suspected or confirmed diagnosis of any condition on the list reports the case immediately by sending AF Form 570, or a form devised locally for this purpose, to the Environmental Health Service. This report may be prepared by support personnel if the diagnosis was entered in the health record.

Telegraphic Reporting. It is the responsibility of the Environmental Health Service to asure that the DBMS, chief of aerospace medicine, and patient affairs are notified of all reported cases. The following four situations require reporting by telegraphic means: (to see where it is sent refer to AFR 168–4 para 12–131f)

(1) The Director of Base Medical SErvices must send a message report immediately upon diagnosis of any of the diseases listed in figure 3-3 under the circumstances specified.

(2) When a situation indicates that a potential health hazard might reach epidemic proportions in military personnel or may interfere with the accomplishment of the military mission.

(3) When illnesses or injuries occur that are suspected or known to be caused by nuclear or chemical warfare.

(4) When there are deaths from any acute infections or parasitic disease, influenza, or rheumatic fever.

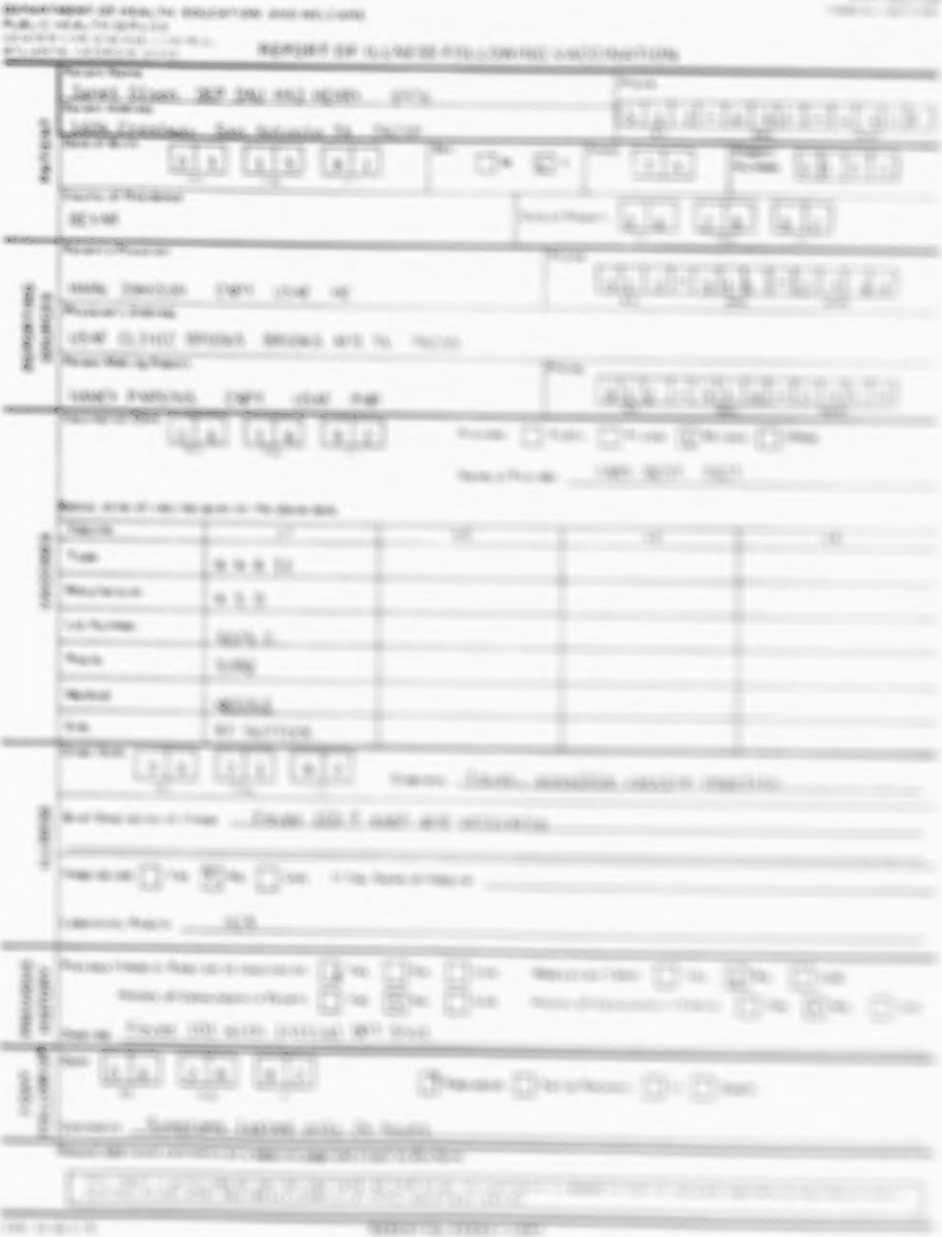
EHS will normally be responsible for preparing the message. Patient Affairs will send the report by priority message upon any of the conditions that require telegraphic notification. This report is sent immediately

NUMBER OF OBSERVED CASES WHICH SHOULD BE REPORTED UNDER SPECIFIED RULES

INSTRUCTION: Use the proper population served line below to find the minimum number of cases that must be observed in populations to require reporting under the stated rule.

If population served by reporting facility is	Number of admissions/cases			
	in 7 days			in 30 days
	3 per wk per 1,000 strength	5 per wk per 1,000 strength	20 per wk per 1,000 strength	10 per yr per 1,000 strength
1- 249	1	2	5	1
250- 499	2	3	8	1
500- 999	2	5	11	2
1,000- 1,499	3	6	21	2
1,500- 1,999	5	9	31	2
2,000- 2,499	7	11	41	3
2,500- 2,999	8	13	51	3
3,000- 3,499	10	14	61	3
3,500- 3,999	11	16	71	3
4,000- 4,499	13	21	81	3
4,500- 4,999	14	23	91	4
5,000- 5,499	16	26	101	5
5,500- 5,999	17	28	111	5
6,000- 6,499	19	31	121	5
6,500- 6,999	20	33	131	6
7,000- 7,499	22	36	141	6
7,500- 7,999	23	38	151	7
8,000- 8,499	25	41	161	7
8,500- 8,999	26	43	171	7
9,000- 9,499	28	46	181	8
9,500- 9,999	29	48	191	8
10,000-10,499	31	51	201	8
10,500-10,999	32	53	211	9
11,000-11,499	34	56	221	10
11,500-11,999	35	58	231	10
12,000-12,499	37	61	241	10
12,500-12,999	38	63	251	11
13,000-13,499	40	66	261	11
13,500-13,999	41	68	271	11
14,000-14,499	43	71	281	12
14,500-14,999	44	73	291	12
15,000-15,499	46	76	301	13
15,500-15,999	47	78	311	13
16,000-16,499	49	81	321	14
16,500-16,999	50	83	331	14
17,000-17,499	52	86	341	14
17,500-17,999	53	88	351	15
18,000-18,499	55	91	361	15
18,500-18,999	56	93	371	16
19,000-19,499	58	96	381	16
19,500-19,999	59	98	391	17
20,000-20,499	61	101	401	17
20,500-20,999	62	103	411	17
21,000-21,499	64	106	421	18
21,500-21,999	65	108	431	18
22,000-22,499	67	111	441	19
22,500-22,999	68	113	451	19
23,000-23,499	70	116	461	19
23,500-23,999	71	118	471	20
24,000-24,499	73	121	481	20
24,500-24,999	74	123	491	21

Figure 3-4. AFR 168-4, figure 12-8, number of observed cases which should be reported under specific rules.



REPORT OF ILLNESS FOLLOWING VACCINATION

Figure 3-5. AFR 160-4, figure 12-10, sample - report of illness following vaccination (CONT'D).

since a potential health hazard may exist. If you are tasked with sending the message refer to paragraph 12-17f of AFR 160-4 for guidance.

Other Reportable Diseases. There are three additional situations in which communicable disease reporting is required: reporting of illness following any vaccination, "special" occupational illness and injury reporting requirements, and the reporting of malaria cases to the Centers for Disease Control (CDC).

Reporting of illness following vaccination. The "report of illness following vaccination" form (fig. 3-5) should be completed if, and only if, the reaction was severe enough to require hospitalization or a visit to a physician or public health facility. The forms are completed according to the guidelines provided on the back of the form. Carbon copies are sent to the Centers for Disease Control, ATTN: Immunization Division, Surveillance and Assessment Branch, 1600 Clifton Road.

Atlanta GA 30333, and the Centers for Disease Control Regional Office for your local area. The white (top) copy is maintained at the medical treatment facility. Additionally, a copy of the report is sent to Defense Medical Material Board, Ft Detrick (Bldg. 833), Frederick, MD 21701. They are responsible for producing the immunizations and need to be notified immediately should it be suspected that an immunization may be bad or contaminated.

Occupation illness and injury report. An AF Form 190, Occupational Illness/Injury Report, is completed on patients whose illness or injury is occupationally related (the AF Form 190 and the related EHS responsiblities will be discussed in another volume). Environmental Health Service forwards a completed copy of the AF Form 190, attached to SF Form 513 (Medical Record—Consultation Sheet) to Patient Affairs. The form is filed in the patient or outpatient health record as appropriate.

Occupationally related illnesses and injuries not involving infectious agents should be reported as stated above (in accordance with AFRs 161-33 and 127-4, *Investigation and Reporting U.S. Air Force Missions.*). However, if the occupationally related illness is caused by an infectious agent(s) (such as hepatitis B as a result of a needle stick) the incidence of disease should be included in the reporting of communicable diseases. A copy of AF Form 190 should accompany this report to higher headquarters.

Malaria case surveillance report for the Centers for Disease Control (CDC). If a case of malaria is diagnosed within an Air Force medical facility located in the CONUS, Alaska, Hawaii, or Puerto Rico, prepare one copy of CDC Form 3.203, Report of Laboratory Investigation, with a blood smear slide from the patient, and send to the Centers for Disease Control, Attn: Parasitic Disease Division, Atlanta GA 30333, via the state or commonwealth health department (some "states" in the United States are considered commonwealths; Virginia, for example). The blood slide must have a thick smear on one end and a thin smear on the other. Additional forms may be obtained from state health departments of the CDC.

Thorough communicable disease reporting is essential to identify any serious outbreaks or epidemics, to document disease chronology, to infer the causes of injury and disease, and to predict future risk of the disease outbreak happening again. You may be requested to make recommendations to various agencies and commanders on how to study and prevent injury and disease. All agencies must be actively involved and do their part in order for the communicable disease reporting program to be effective.

Exercises (034):

1. Who is responsible for preparing a list of USAF reportable diseases? How often is it updated? Who should receive copies of this list?

2. What special situation would require the AF Form 190 to be included in the communicable disease reporting?

3. Using figure 3-3 in each of the following situations, state if it would require reporting through Air Force agencies.

___ (1) 3 cases of cholera.
___ (2) 1 confirmed case of rabies.
___ (3) 2 cases of Botulism.
___ (4) 2 cases of viral hepatitis.
___ (5) 3 cases of measles (rubeola).

3-7. Pathogen Control in the Hospital

A century ago hospitals were dangerous places. Very little was known about the cause and spread of infectious diseases. Sometimes even if the patient survived (a rarity), the hospital staff associated with that patient's care would frequently develop the contagious disease. Pyogenic (or pus producing) infections were thought to demonstrate a "proper" bodily reaction to the injuries. This idea was believed because these types of infections routinely occurred from minor as well as major surgery (or medical treatment). Very little was known about proper air conditioning and ventilation. Effective cleaning and disinfecting agents for personal and environmental sanitation were unavailable. It wasn't until much later that effective techniques were developed for disinfection, sterilization, and asepsis. You will be involved in ensuring that infection control is adequate and appropriate within the hospital.

035. State the duties and responsibilities of the environmental health specialist for pathogen control in the hospital.

Environmental Health Specialist Duties/Responsibilities. Your primary responsibilities as an environmental health specialist in this area of sanitation are as follows:

a. Surveying, investigating, and reporting communicable diseases among hospital personnel and patients to the Infection Control Committee. You must advise them concerning any disease trends. Maintaining accurate records of disease occurrences and trends is essential in accomplishing this task.

b. Educating employees in the basic principles concerning infections, knowledge of hazards in work areas, and the employees' personal responsibility in infection control. This is where you should direct most of your efforts.

c. Monitoring the employee health program. This "monitoring" consists of making recommendations to the Aerospace Medicine Council of lab tests/immunizations necessary for pre-employment and routine physicals; imposing limitations on where personnel may work (i.e., a patient with active herpes may not work in the new born nursery because of the potential of transmission of this agent to children); and performing monitoring of hospital staff personnel to detect outbreaks of disease or people who may require limited exposure to their work environment because of a permanent or temporary medical condition (e.g., in the case of pregnancy).

d. Recommending hospital environmental sanitation practices, waste handling; choice of disinfecting and cleaning solutions; methods of disinfecting and cleaning of people, equipment, and the facility; coordinating with plant management and housekeeping.

Exercises (035):

1. What should your monitoring of the employee health program consist of?

2. Concerning infection control, what should your education of the hospital employees consist of?

3. Why is the health of hospital staff personnel monitored?

4. Why is maintaining accurate records of disease occurrences and trends essential?

036. State the major causative organisms and how pathogens are transmitted within the hospital.

Major Causative Organisms. Antiseptics and sterile techniques have greatly reduced the risk of wound infections. Consequently, less attention has been paid to these techniques with the introduction and development of antibiotic drugs. However, the development of antibiotic resistant strains of staphylococci has again *made this hazard serious.* Gram-negative aerobic bacilli, such as Klebsiella, *E. Coli,* Alcaligenes, Proteus, and Pseudomonas organisms, have been identified most frequently as the causative agents of hospital acquired infections. Infection control procedures are meant to minimize nosocomial (hospital acquired) infections. Infections caused by antibiotic-resistant pathogens are a bigger problem than "wild" varieties. Hospitals clearly serve as the reservoir for most antibiotic-resistant strains. Strains from the general community are for the most part strains that are sensitive to antibiotics. The strains carried by patients on admission are less frequently antibiotic-resistant than strains which are acquired in hospitals. Patients who get these infections in the hospital are potential spreaders of resistant strains in the community after discharge. One of the main factors in the current situation is the widespread use of antibiotics which eliminates susceptible strains of pathogenic microorganisms and leaves the resistant strains uncontrolled.

Certain factors in the patients increase their susceptibility to infection. Among these are physical debility, chronic disease, leukemia, other cancers, extreme youth or age, bed sores, and other open wounds or breaks in the skin.

Pathogen Transmission in the Hospital. How disease agents are transmitted in the hospital can be studied by looking at the types of infections that develop because of them. There are two basic types of infection: endogenous and exogenous. Endogenous infections are those that develop from within the patient—i.e., transfer of a pathogenic organism from one site on a patient to a different site on the same patient. Exogenous infection results from pathogens being transferred from the hospital environment (animate and inanimate) to a patient.

Three basic sources of exogenous infection are: structural inadequacies within fixed buildings, contaminated devices or equipment used, and the practices employed by medical staff or other patients within the hospital. Failure of employees to wash their hands adequately or appropriately (i.e., often enough) is the most frequent cause of exogenous infection! Examples of fixed structure inadequacies are: inadequate air-conditioning system (recirculating unfiltered air) or perhaps the existence of aged water distribution systems. Both of these situations provide reservoirs in the hospital, with a real potential to become "contaminated."

Overcrowding within the facility, as well as inconvenient placement of fixed equipment (sinks), also may be major contributing factors in the transmission of infection. Overcrowding allows infections to be transmitted more easily, and inadequate or improper placement of sinks may make it harder for hospital personnel to wash their hands as frequently as needed.

The equipment or devices used within the medical facility may be a source of infectious agents. Complicated, highly sophisticated, and expensive equipment can lead to sterilization problems. The equipment may be too fragile to allow for thorough disinfection, or the equipment may be handled improperly, cleaned or disinfected with ineffective antimicrobial agents.

Infectious material is conveyed from the medical staff to patients primarily by their hands. Appropriate handwashing is the most effective way to break this mode of transmission. Gloves should be used in high risk areas (e.g., in the nursery for the newborn), or when invasive procedures (i.e., surgery) are done.

Exercises (036):

1. Define nosocomial infections.

2. What are some of the nosocomial infections?

3. Where do you direct most of your efforts in the area of infection control?

4. Why are infections acquired in the hospital so dangerous?

5. What are infections that develop within the patient called?

6. What is exogenous infection transmission dependent upon?

7. Name three basic sources (or ways pathogens are transmitted) that may cause noscomial infections.

037. Cite the functions and responsibilities of the Hospital Infection Control Committee.

Hospital Infection Control Committee. Think of the hospital as a unique "industrial shop." The "parts" worked on are people, and one aspect of servicing these parts is pathogen removal. One of your responsibilities (in accordance with AFR 161-33) is to evaluate and monitor the occupational and environmental health of everyone in the Air Force community. You must integrate and support all preventive medicine and occupational health programs of the other agencies and committees. One avenue of monitoring the occupational environment in the hospital is the Hospital Infection Control Committee of which you are a member. Its major mission is to control and prevent the occurrence of nosocomial infections within the hospital environment. This is done by characterizing the nature and extent of nosocomial infections through disease surveillance and establishing practical, effective hospital policies for infection control. Its primary role is to advise the Director of Base Medical Services (DBMS) concerning matters pertaining to infections. This involves instituting studies to determine sources of infectious agents, determining infection control policies and procedures, and imposing control measures to prevent the spread of nosocomial infections. At some bases the infection control nurse or officer (ICN) has the major input to this committee with the environmental health team member, usually the environmental health officer (EHO) assisting.

The presence of both an ICN and an EHO is valuable to:

a. Reinforce the importance of infection control measures.

b. Provide early identification of epidemics.

c. Provide informal, concurrent in-service education concerning infection control.

d. Provide new information for research efforts in the area of nosocomial infection control.

Hospital environmental sanitation practices should very closely parallel those for other areas. However, there are a few extra routines that are necessary to maintain infection control. Such things as the proper cleaning and maintenance of air conditioning systems, the effective disinfection and sterilization of equipment, and adequate laundry procedures are extremely important. These routines are necessary in addition to such things as proper design of the facility and equipment, adequate space requirements, and dust control (i.e., prohibiting dry sweeping of the facility). Great care must be taken to insure that contaminated linens and blankets are not shaken or mixed with other laundry. Contaminated trucks must not transport clean laundry.

The following brief mention of further control measures will acquaint you with what other hospital personnel (infection control nurse, lab, bioenvironmental engineer (BEE), central supply, housekeeping, etc.) are doing toward prevention of hospital infections:

a. Communicating between hospitals to prevent transfer of infections from one hospital to another.

b. Preventing indiscriminate use of antibiotics to decrease the probability of new resistant strains of pathogens from evolving.

c. Controlling infected hospital personnel's contact with patients.

d. Managing access to high risk areas (newborn nurseries, delivery rooms, operating rooms, and OB and surgical wards).

e. Demanding strict compliance and personal hygiene procedures of all hospital personnel.

f. Maintaining proper disinfection and sterilization of hospital supplies.

g. Insuring proper disposal of infectious hospital waste.

h. Recommending pesticide use and vector control methods.

These are just a few of the measures the rest of the team, of which you are a vital part, are taking in the prevention and control of the spread of hospital infections.

Exercises (037):

1. In one statement cite the responsibility of the Hospital Infection Control Committee.

2. How does this committee determine the nature and extent of nosocomial infections within the hospital?

3. What are your responsibilities as a team member?

4. What other hospital personnel are involved in infection control?

Food and Waterborne Diseases

AS THIS CHAPTER title indicates many diseases may be transmitted to humans through contaminated food and water. Our society has become more advanced and now has better sanitation practices than in the past. However, even though the sanitation process and methods have improved, one unfortunate and sometimes deadly fact remains the same. Our food and water are still surrounded by dangerous agents that can make people sick.

4-1. Etiology and Control of Foodborne Diseases

Etiology and control of foodborne diseases or illnesses refer to the causes and prevention of diseases that are transferred by foods. A number of illnesses can be transmitted in this manner and we must determine which foods are most likely to cause problems, which diseases are poisonings or infections, what are some of the characteristics and growth requirements of the the more common food pathogens, and what controls we can institute to prevent foodborne illness from causing problems on our base.

038. Point out food items that are potentially hazardous (vulnerable).

Potentially Hazardous Foods (Vulnerable). All living organisms generally require certain environmental elements in order to survive. These elements include food, moisture, temperature, and others, depending on the individual characteristics of the organism. Organisms that produce foodborne illnesses are not exceptions to the rule. Foodborne illness producing organisms require food items that possess these characteristics and are therefore good media for their growth. Because many foods are vulnerable to microbiological contamination during handling in the kitchen environment, and are good media for microorganism growth, they are considered potentially hazardous. Food items such as meat, eggs, poultry, fish, milk and milk products, and shellfish are all good examples of potentially hazardous foods. However, when food items of this nature receive further processing such as when they have been ground, creamed, mixed, of handled a great amount they are especially hazardous. Hash, gravies, dressings, bread puddings, creamed meats, and high protein salads consisting of egg, tuna, meat and/or poultry, are good examples. Many of the food items being served in Air Force dining facilities are susceptible to microbiological contamination and are potentially hazardous. You must understand proper preparation and handling techniques to prevent these items from being the cause of a foodborne illness outbreak. These techniques will be thoroughly discussed in this chapter.

Exercises (038):

1. From the list of food items, select the ones that are potentially hazardous (vulnerable) by answering yes or no.

___ (1) Turkey.
___ (2) Pickles.
___ (3) Egg salad.
___ (4) Tuna salad.
___ (5) Rice.
___ (6) Creamed beef.
___ (7) Jello.

039. Given terms related to foodborne disease, identify the types of illness and the causative agents.

Foodborne Illnesses. In this segment we present various causes of foodborne illness, point out disease symptoms, and cite preventive measures. Of course, disease prevention is our ultimate goal. Foodborne illnesses are of two general categories; those having a delayed onset (usually infections) and those occurring abruptly in nature (usually intoxications).

Foodborne infections. These illnesses are caused by ingesting food or drink containing pathogenic organisms (viruses, bacteria, protozoa, and various parasites). The delayed onset of symptoms suggests the growth of organisms after ingestion, and therefore the illness is not necessarily related to the amount of offending food ingested. Let's discuss some of the more common foodborne infections that might adversely affect the mission at your base.

Salmonellosis. More than 1700 serotypes of salmonellae exist; among these is the notorious typhoid organism. Salmonella organisms cause a high percent of foodborne infections; they are believed to be the most common cause of foodborne infection. The salmonella infections are common in animals and especially birds. Therefore, infection may result from eating improperly prepared, preserved, or cooked meats from these sources. Ground meat and sausage are especially vulnerable. Outbreaks often result from contamination of food from external sources through cross contamination. Foodhandlers, insects, and rodents may carry and transfer the organisms to food products. Specific circumstances are necessary for an outbreak of salmonellosis. These circumstances are:

a. Contamination of food capable of supporting growth of salmonella.

b. Favorable temperature (45° F. (7° C.) to 115° F. (46° C.)).

c. Sufficient time for organisms to multiply to a dangerous level (usually at least 4 hours).

Symptoms occur between 6 and 48 hours after ingestion (average 18 hours). They vary from slight nausea of short duration to severe headache, chills, fever, violent retching, colic, and diarrhea. Recovery may take from 1 to 3 days to up to a week. Death has occurred but is rare except in highly susceptible groups such as young children, the aged, and those otherwise ill.

Control measures are similar to those involving other foodborne illnesses and include:

a. Chill foods rapidly; cook foods thoroughly.

b. Maintain cleanliness of food, foodhandlers, and equipment.

c. Employ noninfected foodhandlers, because a carrier state exists.

d. Insure proper handling, thorough cooking, and adequate storage of susceptible foods, especially adequate refrigerated storage.

e. Use pasteurized dairy and egg products.

f. Use eggs whose shells have not been cracked.

g. Sanitize equipment.

Streptococcal foodborne infections. The causative circumstances surrounding a streptococcal foodborne infection generally parallel those of a salmonella outbreak. The incidence of streptococcal foodborne infection is less and the symptoms are milder than those of salmonellosis. These symptoms may begin 1 to 3 days after ingestion of infective food. They often include sore and red throat, high fever, and vomiting.

The infectious agent is *Streptococcus pyogenes,* which cause sore throats and scarlet fever, and may be transmitted to food through droplet infection (spread by talking, coughing, and sneezing). Susceptible foods include poultry and eggs, potato salad, meat dishes, and low-acid foods. Control measures include:

a. Chill foods rapidly; cook foods thoroughly.

b. Practice personal hygiene.

c. Use pasteurized milk products.

d. Exclude workers from handling foods if suffering from respiratory illness or skin lesions.

Hepatitis A. Hepatitis A is a viral disease which occurs worldwide. Humans are the reservoir. Source of the infection is feces from infected persons. The virus can be transmitted by person-to-person contact, or through the fecal-oral route. It is also transmitted through ingestion of contaminated food and water. The incubation period is 10–50 days with an average of 30 days. Therefore, it is very difficult to trace an outbreak of hepatitis on investigation. Control and epidemiological investigation center around possible transmission by water or food. Special efforts should be made to improve sanitation and personal hygiene. Reduction of fecal contamination of foods and water should be stressed.

Miscellaneous foodborne infections. Many miscellaneous diseases not yet mentioned are transmitted through the food chain. These do not occur as often as those previously described. Among these are numerous intestinal parasites such as pork, beef, and fish tapeworms, and other helminths; intestinal viruses and bacterial diseases such as brucellosis, campylobacter, and many others.

Many of these diseases are primarily diseases of animals but are capable of infecting human beings through ingestion of the organisms in improperly prepared or processed foodstuffs, or by direct transmission from the animal. The source of infection is often food that has been improperly prepared or processed. Undercooked meats may contain infective tapeworms or trichinae; and raw milk from infected animals can be a prime source of brucellosis, diphtheria, Q-fever, or bovine tuberculosis. In most instances, veterinarians control these disease through vaccination of herds or slaughter of infected animals where a cure is not possible or feasible. In trichinosis control, cooking of raw garbage to be used as hog food is the primary preventive measure. Additionally, as meat inspectors are not looking for trichina in the United States, we have over the years been taught to cook pork until well done. This assures destruction of the trichina. Veterinary meat inspection, both before and after slaughter, further controls the transfer of many animal diseases, other than trichina.

Control of the transmission point in some instances is the best method of prevention of many of these diseases. Pasteurization of milk is the intermediate control in brucellosis, Q-fever, and bovine tuberculosis. Pork must be cooked thoroughly to prevent trichinosis, and all other meats should be cooked adequately to control parasites. Thorough cooking of all pork products is a realistic and satisfactory positive control.

Foodborne intoxications/toxico infections.The most common cause of foodborne intoxication is bacteria, although poisonous plants, animals, and chemical intoxication are occasionally the cause of serious outbreaks. Bacteria cause illness by releasing toxic products into the food; many of these bacteria are constantly present in healthy individuals. Chemical intoxication is often caused by preparing or storing food in containers made of materials that are toxic to humans, usually a metallic container with an acid food, tomatoes, or fruit juices in it. Some plants and animals are naturally poisionous to humans, but are sometimes prepared for food when this danger is not properly understood.

Staphylococcal foodborne intoxication. Staphylococcus organisms are usually present on our bodies but, luckily, not all types cause food poisoning. Only those specific types that produce a toxin will cause trouble. Toxin-producing staph may be found in the mouth and nose, infected cuts, boils, pimples, feces, and on dirty hands and arms. Boiling usually does not destroy the toxin produced by staph. The only sure way to prevent staphylococcus food poisoning is to prevent the bacteria from getting into food and by storing the food under conditions that will not allow the staph to grow, even if present.

Staphylococci grow and reproduce in warm, moist, high-protein foods. They survive in higher salt and sugar concentrations than do most of the other pathogens. Therefore, products such as cooked ham, custards, and cream filled pastries are especially susceptible to staphylococcus intoxication. You will notice that all these foods are cooked. This is typical of a staph outbreak. Staph is a poor competitor and does not do well when other bacteria are present. Cooking destroys all bacteria but then staph present on hands recontaminates the food and causes problems. Meats, egg products, and salads made from meat, eggs, or unacidified mayonnaise are also frequent offenders. At temperatures between 67° F. (19 ° C.) and 115° F. (46° C.) food can become toxic within 5 hours. Cold does not kill the bacteria, but it inhibits the growth and reproduction processes. High temperatures kill the organism but do not destroy the toxin which has already been produced. Therefore the toxin is heat stable.

Prevention of contamination and proper refrigeration are the keys to control. Foodhandlers with open sores, boils, cuts, skin rashes, or gastrointestinal upsets should not be allowed to work until they are well and have been cleared for return to duty by a physician. Daily examination of foodhandlers by their supervisor is especially necessary to detect these problems. Education of foodhandlers, to convince them of the need to wash their hands periodically throughout the day and after visits to the latrine, is a basic preventive measure. Use of wholesome products, clean utensils, proper handling techniques, and adequate refrigeration are vital. Nothing can be done to destroy the toxin, except to throw out the food. An important rule to teach is "keep hot foods hot (above 140° F. (60° C.) and cold foods cold (below 45° F. (7° C.)."

Symptoms of staphylococcus food poisoning may begin to occur in less than 1 hour, and the illness usually reaches its peak in 2 to 4 hours. Symptoms may vary from mild nausea to extreme prostration with cramps, vomiting, and diarrhea. Projectile vomiting is often seen with this problem. Recovery usually occurs within 24 to 48 hours; deaths have occurred as a result of staph food poisoning, but they are very rare.

Botulism. This spore-forming organism, *Clostridium botulinum*, grows in an absence of air and produces a highly fatal toxin which affects humans even in very small amounts. *C. botulinum* lives in decaying animals, soil, silt of lakes, and is often found in animal intestinal tracts. Food that comes in contact with contaminated soil picks up this organism which releases a toxin as it grows under anaerobic conditions. The toxin is destroyed by boiling for 5 minutes, but the botulinum spores are much more resistant. They may be killed by boiling for 5 hours at 212° F. (100° C.) or for 40 minutes at 238° F. (115° C.) (pressure cooker). This extreme killing requirement explains why underprocessed, home-canned, garden vegetables have been the source of numerous cases of botulism. Nonacid foods such as peas, beans, corn, and meat are the worst offenders. Smoked, vacuum packed fish and fermental meats have been involved in outbreaks.

Symptoms of botulism vary considerably, depending upon the amount of toxin ingested. Symptoms may appear at any time between 2 hours to 8 days (usually 12 to 48 hours) after consuming the toxin. They may include nausea, vomiting, abdominal pain, and diarrhea early followed by double vision, loss of control of eye movement, and difficulty with speech, swallowing, and breathing. These symptoms may progress until there is complete muscular paralysis. Mortality rate is usually high (50 to 65 percent) and death may occur within 3 to 10 days after poisoning.

Prevention of botulism is based upon proper preparation of foods. Home-canned, nonacid foods should be avoided. Inspect all canned foods and discard bulging cans. When in doubt, throw it out. Don't taste to determine safety.

Clostridium perfringens. This is another anaerobic organism which has gained considerable attention in recent years. It inhabits the intestinal tract of humans and animals and is the most prevalent spore-forming bacteria in the soil. It is also a common cause of gas gangrene.

Although we discuss this organism as an intoxicant, it should be remembered that research has recently identified this organism as a toxico infection (it is both an intoxicant and a infective agent). Remember, the time of onset of symptoms is one method used to classify a foodborne illness as either intoxication or infection.

Cooked meats and poultry have been the chief offenders in outbreaks of foodborne illness involving *C. perfringens*. Unrefrigerated chicken broth provides an ideal culture medium. Rolled meat roasts, meat pies, and turkey are often the source of outbreaks. These types of foods or conditions afford the slightly anaerobic environment which promotes the growth and reproduction of *C. perfringens*. Improper handling and processing of poultry and meat increase the hazard of contamination. Improper removal of soil from vegetables has also caused outbreaks. Inadequate refrigeration, improper cleaning, and exposure of food to dust and air all contribute to the growth of *C. perfringnes*.

Symptoms of *C. perfringens* foodborne illness are generally of short duration, usually 1 day or less, and complete recovery usually follows. The symptoms, which appear in 8 to 12 hours, include acute abdominal pain, gas, diarrhea, chills, and fever. Nausea is mild, if present, and vomiting is uncommon, since this is primarily a lower intestinal syndrome. Controls and preventive measures generally involve proper preparation and storage of meat and poultry dishes:

a. Serve foods hot, immediately after preparation. Cool (below 45° F. (7° C.)) leftovers rapidly and reheat (above 140° F. (60° C.)) them rapidly.

b. Use a meat thermometer to insure adequate, thorough cooking of thick cuts and interior portions.

c. Limit depth of stews, gravies, etc., to 4 inches is small containers for refrigerated storage.

d. Insure proper techniques of handling and cleaning of vegetables and poultry.

Nonbacterial poisons. In addition to bacterial poisons, poisonous chemicals from higher plants and animals can cause symptoms when consumed. Among the offenders that have caused outbreaks of poisoning are fava beans, water hemlock, rhubarb leaves, mussels, some species of fish, shellfish that have eaten poisonous plankton,and some mushrooms. Two species of mushrooms, both of the genus Amanita, are very dangerous. Onset of symptoms from these mushrooms may occur within minutes to 2 hours after consumption of *A. muscarine* or from 6 to 15 hours if due to toxin of *A. phalloides.*

Other types of nonbacterial poisons are those which do not originate from plants or animals. These are the inorganic chemical poisons. Included in this group are insecticides which have been used on fruits and vegetables; copper and cadmium-plated, enameled (antimony), or galvanized (zinc) pots and pans in which acid foods are prepared and stored; and lead, fluorides, and cyanides. These chemical poisons often cause violent symptoms which may begin in a very short time (10 minutes to 2 hours) after ingestion of the poison.

Why do these illnesses occur? Foodborne intoxication or foodborne infection is caused primarily by persons who prepare and serve food and who fail to apply known food protection measures. Acts of carelessness of ignorance lead to contamination of food with bacteria or with material that causes foodborne illness.

Exercises (039):

1. Identify the following foodborne illnesses and causative agents as being (a) a foodborne infection and/or (b) a foodborne intoxicant.

____ (1) Salmonellosis.
____ (2) Botulism.
____ (3) Trichinosis.
____ (4) Shellfish.
____ (5) Streptococcosis.
____ (6) Viruses.
____ (7) Fava beans.
____ (8) *Clostridium perfringens.*
____ (9) Inorganic chemicals.
____ (10) Diptheria.

2. Match the major causative items in column B with the improper procedure in column A. *Note:* Each organism or disease listed in column B is generally associated with an improper procedure listed in column A. Items in column B may be used more than once, and there may be more than one answer for each question.

Column A

___ (1) Canning temperatures too low.
___ (2) Foodhandler with infected sore.
___ (3) Inadequate pasteurization.
___ (4) Undercooked meat.
___ (5) Cross contamination of raw and cooked chicken.
___ (6) Contaminated water reservoir.
___ (7) No sneeze guard on serving line.
___ (8) Chicken broth stored under refrigeration in a pan 12 inches deep.

Column B

a. Salmonella.
b. Streptococcus.
c. Hepatitis.
d. Tapeworm.
e. Q Fever.
f. Staphylococcus.
g. Botulism.
h. *C. perfringens.*

040. Specify the four factors that must be present to enable foodborne illness to occur.

Sequence of events in a foodborne illness. There is a certain sequence of events that must take place before a foodborne illness can occur. There must be an abuse of a foodhandling procedure, an offending agent present, a vehicle to transmission (food), and a susceptible consumer. We do not live in a sterile world and must eat to survive; thus the agent, the vehicle, and the consumer will always be present. Foodborne illnesses can only be eliminated by applying and practicing safe foodhandling procedures. Let's look more closely at this sequence of events.

Agent. A 10 year analysis of data compiled and published by the Centers for Disease Control (CDC) revealed that over 68 percent of all confirmed cases of foodborne illnesses for the 10 years studied were attributed to a bacterial agent. The other agents involved and their percentage of involvement in foodborne illnesses are as follows:

Chemical - 23 percent
Parasite - 6 percent
Viral - 3 percent

Do not equate these small percentages with lack of importance. Chemical poisonings are in some years high on the list as far as numbers of illness. This type of illness could easily occur if we are not doing our job not only in food inspection but also in medical evaluations and foodhandler's training.

Vehicle. Some foods are better suited to bacterial growth. Potentially hazardous foods are usually moist and have high-protein and low-acid content. All foods are susceptible to post-preparation contamination by foodhandlers and chemicals, so don't just suspect the potentially hazardous food. Be alert to all food handling deficiencies!

Consumer. This is the individual who eats the meal, buys the food at the comissary, or takes the sandwich from a vending machine and eats a quick snack. Certain individuals are more susceptible to foodborne disease than others. The size, age, present health, and eating habits determine the effects consumption of a contaminated food will have on an individual. These effects can be anything from nausea to death.

Abuse of foodhandling procedures. Although this is our last consideration, it is the first to occur when a foodborne illness strikes a consumer. Foodhandling procedures actually begin when an item is selected to be placed in the food chain. A diseased animal that happens to be placed into the chain got there because of failure to follow proper procedure. The general aspects of preventing the growth of bacteria and the adulteration of food items is our major concern for this section. In a later section we will discuss the specific sanitary control measures with which we must be familiar. To control foodborne diseases we must inspect the food: maintain adequate temperature during storage, preparation, and serving; perform medical and supervisory examination of foodhandlers; and supply adequate health education to all foodhandlers. Microorganisms grow between 45° F. (7° C) and 140° F. (60° C), with normal body temperature being the most conducive to growth.

Exercises (040):

1. What are four events or factors necessary for a foodborne illness to occur?

2. What causes most foodborne illnesses?

3. Beer, cake, hamburgers, and potato salad were served at a picnic. Several people started vomiting 4 hours later. What is the most likely vehicle of transmission?

4. Cite four characteristics of a consumer that affect his response to consumption of contaminated food.

4-2. Foodborne Illness Outbreak Investigation

You have spent much time reading about the prevention of foodborne illnesses. Thus, you may feel quite confident in this area. However, what if something goes wrong? Some evening you've just gotten home from a party and your NCOIC calls and says, "Come to the hospital. We've got a foodborne disease outbreak on our hands." What do you do? You can't go on leave—no, you're going to go and do the best job you can to determine what disease is causing the problem; what went wrong to cause the outbreak; and what will be the Environmental Health Service's recommendation to prevent this in the future.

Let's focus our attention first on the sequence of events after you learn of an outbreak, and then analyze the reports required during an outbreak investigation.

040. Cite responsibilities and requirements in completing an investigation of a foodborne illness, and list the factors necessary to cause an outbreak.

Preparation. If your base has a good food service sanitation program, a foodborne illness outbreak will not likely occur. However, your office should be prepared to respond rapidly in the event an outbreak does occur. Every environmental health technician should be familiar with the items contained in the Environmental Health Service's foodborne illness outbreak kit. The kit should contain such items as sterile bottles, gloves, tongs, spatulas, pencils, paper, and a supply of forms used in the investigation—AF Form 431, Food Poisoning Outbreak (Individual Case History), AF Form 432, Time Distribution of Persons Affected, and CDC Form 52.13. We will discuss these forms later. Every member of the Environmental Health Service should be trained twice each year on the use of the kit and conducting an investigation. Also, hospital personnel with initial patient contact should receive annual training in the proper procedures to follow during a foodborne illness outbreak. This training is given by the base environmental health officer.

Notification. To insure a rapid response to an outbreak, a notification plan or recall roster should be developed by the hospital. As soon as medical authorities decide that an actual foodborne illness outbreak is occurring the recall plan should be put in effect.

Investigation. To properly investigate an outbreak, it is best to understand what takes place that causes an outbreak. Let's review the events or factors involved. First, an infective agent must be present. There must be a source or reservoir. Where did the organism come from? Is it common to a particular food item? Is it on a food contact surface that wasn't cleaned properly? Microorganisms are nonmotile for all practical purposes; therefore, a mode of transmission is needed to move the organism from place to place. Did a gust of wind blow it onto the food? Did a foodhandler transfer the organism on his hands or a utensil from its source to food? There must be a potentially hazardous food present. Unless the organism has a good medium for growth it usually can't do any harm. The temperature must be adequate to permit growth (45° F. to 140° F. (7° C. to 60° C.)). The organism must have had enough time to multiply to an infective level (normally greater than 4 hours). Finally, there must have been someone who is susceptible to the foodborne illness. Now that the probably factors involved in causing the outbreak have been reviewed, let's continue the discussion of conducting an investigation.

While physicians and medical corpsmen are examining and treating patients, other hospital personnel are collecting patient excreta and vomitus for submission to the laboratory. Environmental health personnel and others will be interviewing patients to find out as much information about the outbreak as possible. The interview should include learning what meals were eaten within the last 72 hours, what time, were they eaten, and where they were consumed. While conducting the interview, it should become fairly evident that a common meal and a common source such as a dining hall or cafeteria are probably responsible for the outbreak. A sanitary inspection of the suspect facility should be conducted as soon as possible along with the collection of the food items served (if this is still possible) and how they were prepared. Laboratory work should be progressing to identify the agent responsible for the disease.

Foodborne Investigation Samples. Vomitus and stool should be collected in sterile airtight containers and submitted to the local base hospital laboratory for analysis. Only under very extreme conditions would samples be shipped to laboratories other than those in the local areas. Time is critical! The sooner the agent is identified, the sooner patients can be treated and the suspected foods can be eliminated. Remember to advise the laboratory of your suspicions as to cause or etiology of the outbreak. If you suspect an anaerobic organism such as *Clostridium perfringens*, the laboratory must attempt to grow the organism in an anaerobic as well as aerobic environment.

At this point in the sequence of events involved in a foodborne illness outbreak we have gathered together most of the information required to complete our investigation. Be cure as many people as possible have been interviewed. This should include sick diners and well diners who ate the suspect meals. Often this important point is overlooked and the investigation cannot be completed without this comparison.

Exercises (041):

1. Name five items of equipment that should be placed in a foodborne illness kit.

2. Who is responsible for providing annual training to hospital personnel with initial patient contact on proper procedures to follow during a foodborne illness outbreak?

3. List the factors or events necessary to cause a foodborne illness.

4. When patients are interviewed, how many hours should be covered?

5. When a facility becomes suspect during the interview, what should be done as soon as possible?

042. State the purpose of forms used in reporting foodborne illness outbreaks and make common calculations and entries using these forms.

Completion of Forms. Now that you are ready to conclude an investigation, let's create a hypothetical problem, review some of the investigative steps we have already discussed, and fill out the necessary forms.

Assume that 100 people are at a picnic. The group consists of 50 couples, ranging in age from 21 to 40. At the picnic, the following menu is available: cold chicken, sliced ham, potato salad, baked beans, jello, cola, beer, coffee, rolls, and butter. About 3 or 4 hours after eating, people from the picnic begin to appear at the hospital complaining of diarrhea, cramps, nausea, and vomiting. In order to plan a study of the cause of the outbreak, you are asked to interview the people involved and to record the results of the interviews. What information will you want to obtain? How will you tabulate the data so that it may be easily studied?

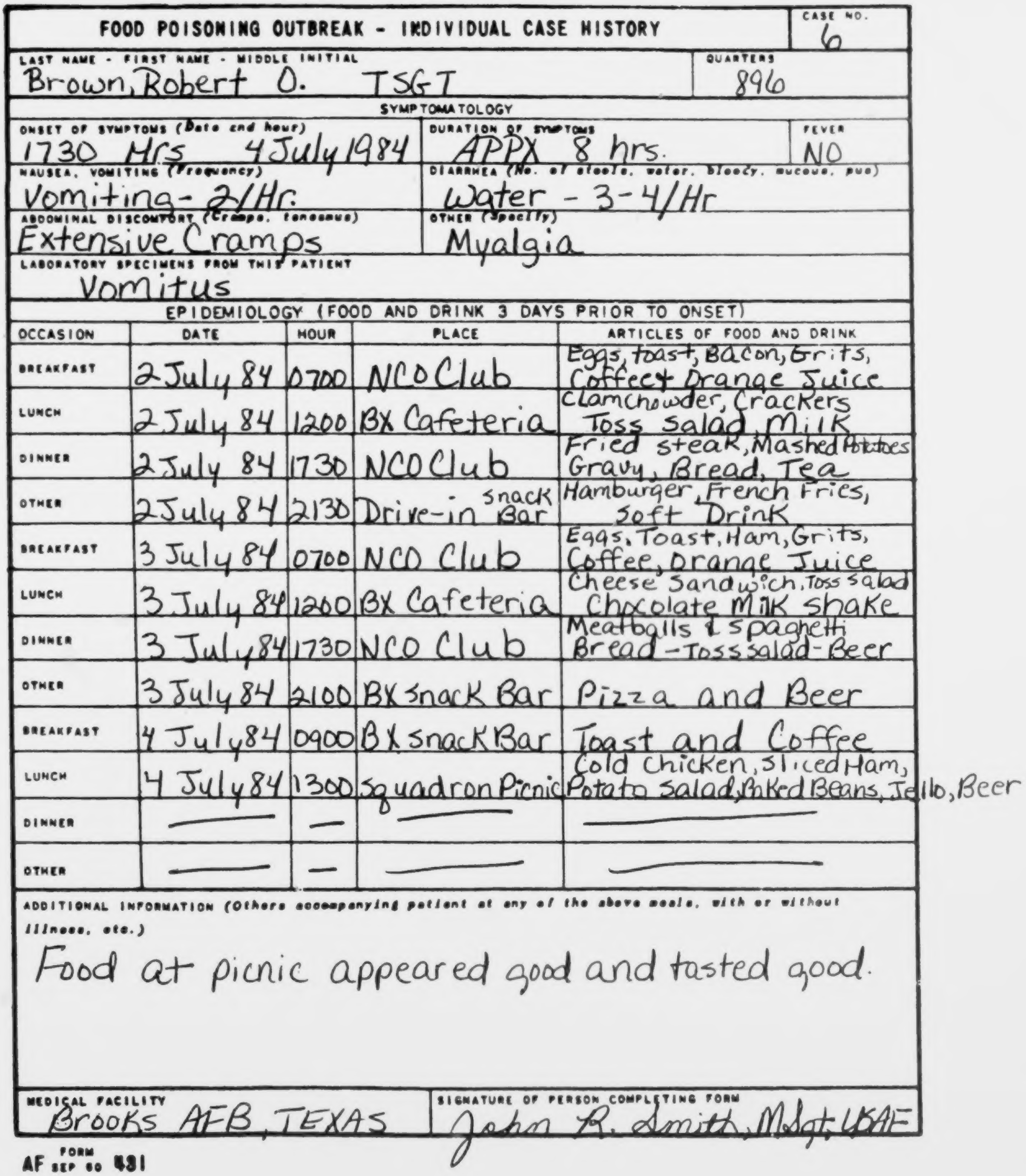
First, decide what questions you want answered; then formulate a group of questions to ask each individual. The questions you want answered should include the following: (1) What organism probably caused the outbreak? (2) What food or combination of foods contained the organism? (3) What caused the food to become contaminated? (4) How could the outbreak have been prevented? (5) Whom should you interview? In order to answer the necessary questions quickly, only the sick people are readily available; however, a representative number of the well people should also be interviewed. To be more thorough, if time permits, all 100 people should be interviewed.

What questions are necessary to establish the identity of the organism? You know from previous study that organisms that cause foodborne illness react in certain predictable ways—i.e., time between ingestion of food and onset of symptoms, and characteristic symptoms of various organisms. From this, you can determine that you need to know: (1) What symptoms each person displayed, (2) which foods each person ate and the time the meal was consumed, and (3) what time the symptoms began. To determine what food or drink contained the organism, you must try to find the common denominator—the one meal that was common to all the patients, and the one food or beverage from that meal that was consumed by all those who became ill. Therefore, list the items consumed by each individual at each meal for the past 3 days.

Now look at figure 4-1. Here is a reproduction of AF Form 431, Food Poisoning Outbreak—Individual Case History, which is especially designed for obtaining data on individuals involved in food poisoning outbreaks. One of these forms will be filled out on each individual concerned. Note that the form has ample space to record physical symptoms with their onset and duration; and for a record of the foodstuffs consumed for the last 3 days (don't forget snacks), along with date, hour, and place. The last entry on the form should list some of the articles of food that were served at the picnic.

After the individuals involved have been interviewed and the results have been recorded of AF Form 431, you should have an overall picture of how many people consumed each food item and the incidence of illness in relation to each food item.

Now refer to figures 4-2 and 4-3 (front and back of



FOOD POISONING OUTBREAK - INDIVIDUAL CASE HISTORY

CASE NO. 6

LAST NAME - FIRST NAME - MIDDLE INITIAL: Brown, Robert O. TSGT

QUARTERS: 896

SYMPTOMATOLOGY

ONSET OF SYMPTOMS (Date and hour): 1730 Hrs 4 July 1984

DURATION OF SYMPTOMS: APPX 8 hrs.

FEVER: NO

NAUSEA, VOMITING (Frequency): Vomiting - 2/Hr.

DIARRHEA (No. of stools, water, bloody, mucous, pus): Water - 3-4/Hr

ABDOMINAL DISCOMFORT (Cramps, tenesmus): Extensive Cramps

OTHER (Specify): Myalgia

LABORATORY SPECIMENS FROM THIS PATIENT: Vomitus

EPIDEMIOLOGY (FOOD AND DRINK 3 DAYS PRIOR TO ONSET)

OCCASION	DATE	HOUR	PLACE	ARTICLES OF FOOD AND DRINK
BREAKFAST	2 July 84	0700	NCO Club	Eggs, toast, Bacon, Grits, Coffee + Orange Juice
LUNCH	2 July 84	1200	BX Cafeteria	ClamChowder, Crackers Toss Salad, Milk
DINNER	2 July 84	1730	NCO Club	Fried steak, Mashed Potatoes Gravy, Bread, Tea
OTHER	2 July 84	2130	Drive-in Snack Bar	Hamburger, French Fries, Soft Drink
BREAKFAST	3 July 84	0700	NCO Club	Eggs, Toast, Ham, Grits, Coffee, Orange Juice
LUNCH	3 July 84	1200	BX Cafeteria	Cheese Sandwich, Toss salad Chocolate Milk shake
DINNER	3 July 84	1730	NCO Club	Meatballs & spaghetti Bread - Toss salad - Beer
OTHER	3 July 84	2100	BX Snack Bar	Pizza and Beer
BREAKFAST	4 July 84	0900	BX Snack Bar	Toast and Coffee
LUNCH	4 July 84	1300	Squadron Picnic	Cold Chicken, Sliced Ham, Potato Salad, Baked Beans, Jello, Beer
DINNER	—	—	—	—
OTHER	—	—	—	—

ADDITIONAL INFORMATION (Others accompanying patient at any of the above meals, with or without illness, etc.)

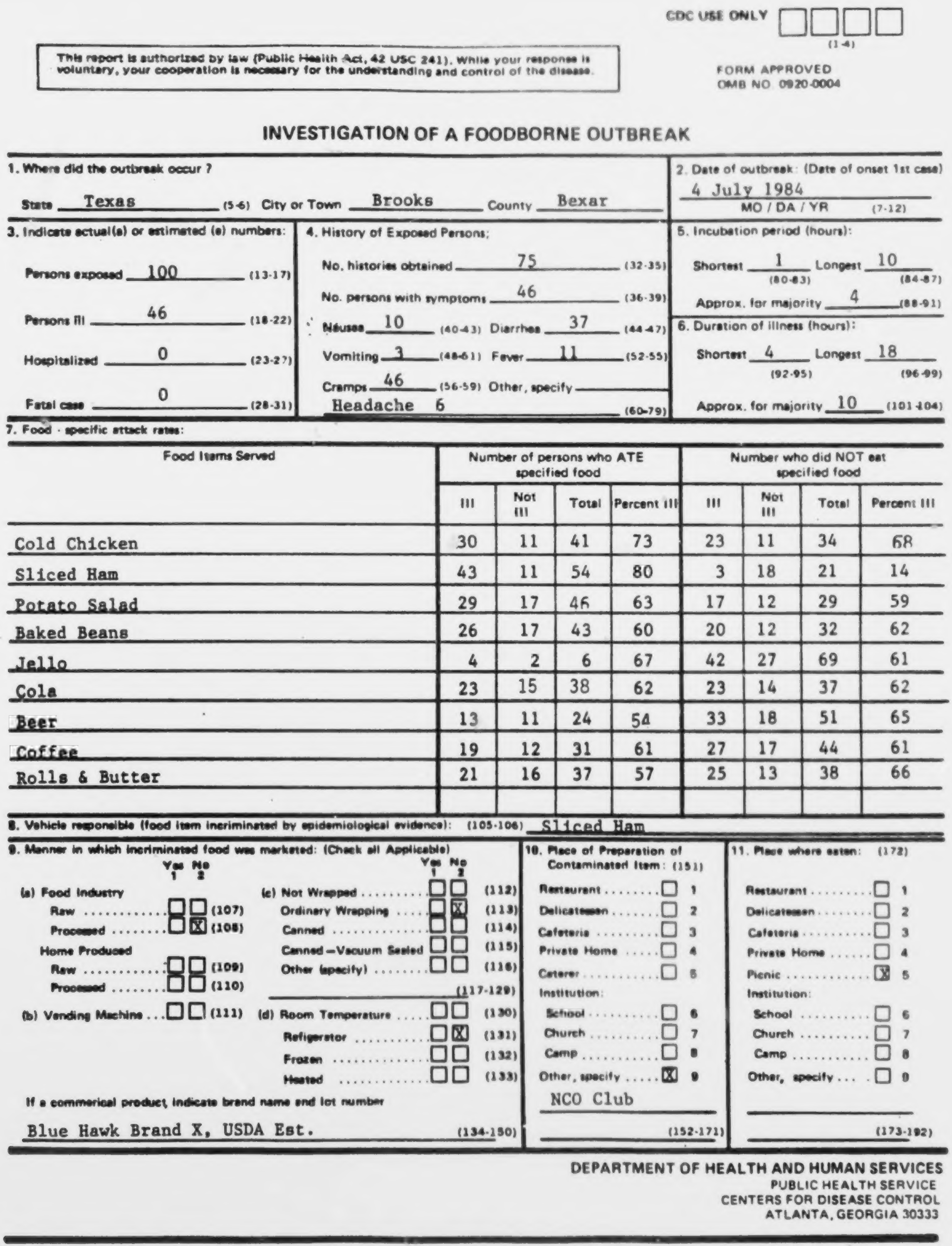
Food at picnic appeared good and tasted good.

MEDICAL FACILITY: Brooks AFB, TEXAS

SIGNATURE OF PERSON COMPLETING FORM: John R. Smith, MSgt, USAF

AF FORM SEP 60 431

Figure 4-1. Sample, AF Form 431.



CDC USE ONLY ☐☐☐☐ (1-4)

This report is authorized by law (Public Health Act, 42 USC 241). While your response is voluntary, your cooperation is necessary for the understanding and control of the disease.

FORM APPROVED
OMB NO. 0920-0004

INVESTIGATION OF A FOODBORNE OUTBREAK

1. Where did the outbreak occur ?
State Texas (5-6) City or Town Brooks County Bexar

2. Date of outbreak: (Date of onset 1st case)
4 July 1984
MO / DA / YR (7-12)

3. Indicate actual(a) or estimated (e) numbers:
Persons exposed 100 (13-17)
Persons Ill 46 (18-22)
Hospitalized 0 (23-27)
Fatal case 0 (28-31)

4. History of Exposed Persons;
No. histories obtained 75 (32-35)
No. persons with symptoms 46 (36-39)
Nausea 10 (40-43) Diarrhea 37 (44-47)
Vomiting 3 (48-51) Fever 11 (52-55)
Cramps 46 (56-59) Other, specify
Headache 6 (60-79)

5. Incubation period (hours):
Shortest 1 (80-83) Longest 10 (84-87)
Approx. for majority 4 (88-91)

6. Duration of illness (hours):
Shortest 4 (92-95) Longest 18 (96-99)
Approx. for majority 10 (101-104)

7. Food - specific attack rates:

Food Items Served	Number of persons who ATE specified food				Number who did NOT eat specified food			
	Ill	Not Ill	Total	Percent Ill	Ill	Not Ill	Total	Percent Ill
Cold Chicken	30	11	41	73	23	11	34	68
Sliced Ham	43	11	54	80	3	18	21	14
Potato Salad	29	17	46	63	17	12	29	59
Baked Beans	26	17	43	60	20	12	32	62
Jello	4	2	6	67	42	27	69	61
Cola	23	15	38	62	23	14	37	62
Beer	13	11	24	54	33	18	51	65
Coffee	19	12	31	61	27	17	44	61
Rolls & Butter	21	16	37	57	25	13	38	66

8. Vehicle responsible (food item incriminated by epidemiological evidence): (105-106) Sliced Ham

9. Manner in which incriminated food was marketed: (Check all Applicable)

	Yes 1	No 2	
(a) Food Industry			
Raw	☐	☐	(107)
Processed	☐	☒	(108)
Home Produced			
Raw	☐	☐	(109)
Processed	☐	☐	(110)
(b) Vending Machine	☐	☐	(111)
(c) Not Wrapped	☐	☐	(112)
Ordinary Wrapping	☐	☒	(113)
Canned	☐	☐	(114)
Canned—Vacuum Sealed	☐	☐	(115)
Other (specify)	☐	☐	(116)
			(117-129)
(d) Room Temperature	☐	☐	(130)
Refrigerator	☐	☒	(131)
Frozen	☐	☐	(132)
Heated	☐	☐	(133)

If a commerical product, indicate brand name and lot number
Blue Hawk Brand X, USDA Est. (134-150)

10. Place of Preparation of Contaminated Item: (151)

Restaurant	☐	1
Delicatessen	☐	2
Cafeteria	☐	3
Private Home	☐	4
Caterer	☐	5
Institution:		
School	☐	6
Church	☐	7
Camp	☐	8
Other, specify	☒	9

NCO Club
(152-171)

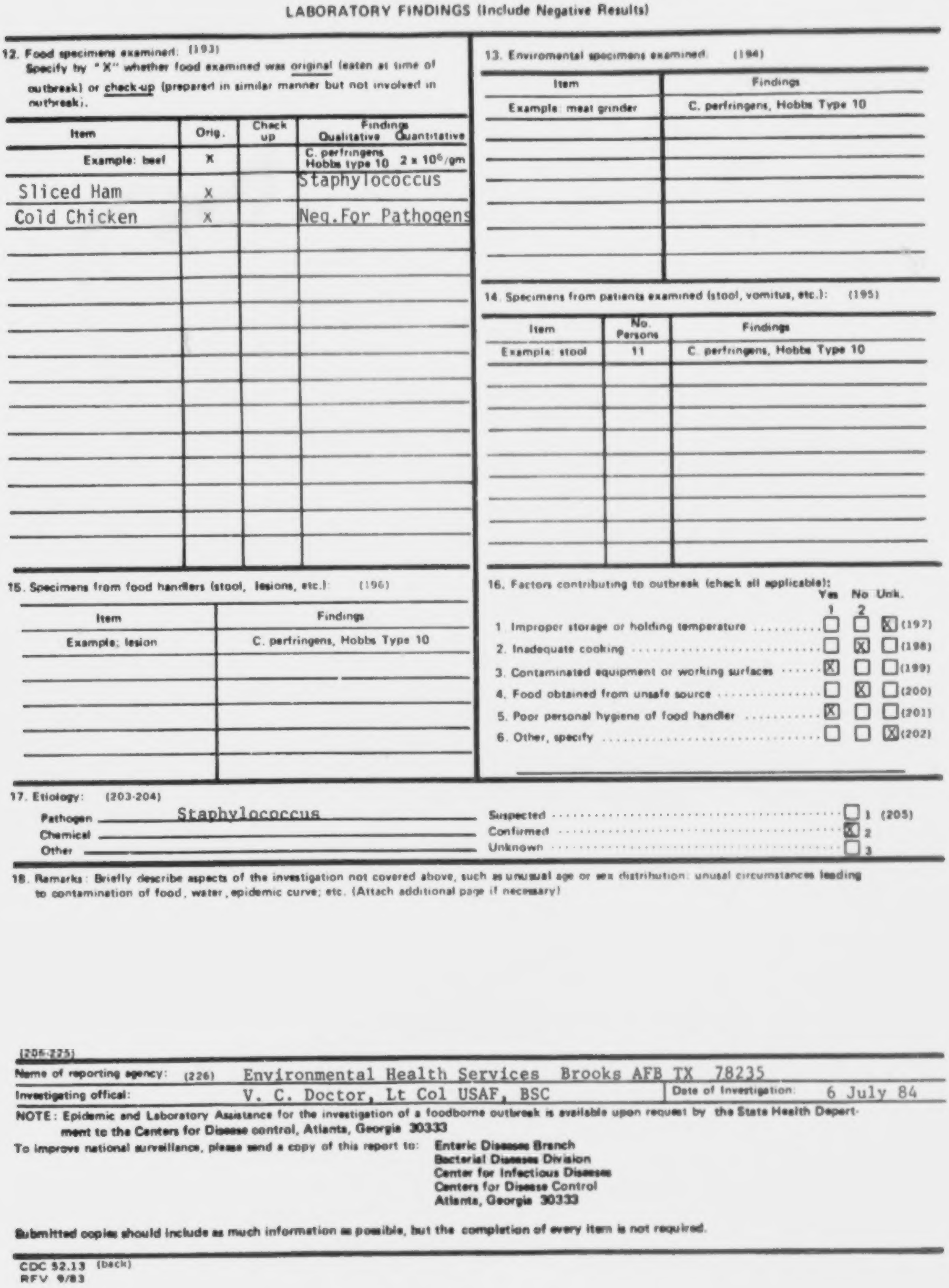
11. Place where eaten: (172)

Restaurant	☐	1
Delicatessen	☐	2
Cafeteria	☐	3
Private Home	☐	4
Picnic	☒	5
Institution:		
School	☐	6
Church	☐	7
Camp	☐	8
Other, specify	☐	9

(173-192)

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

Figure 4-2. DHEW PHS Form, CDC 52.13 (completed front).



LABORATORY FINDINGS (Include Negative Results)

12. Food specimens examined: (193)
Specify by "X" whether food examined was original (eaten at time of outbreak) or check-up (prepared in similar manner but not involved in outbreak).

Item	Orig.	Check up	Findings Qualitative	Findings Quantitative
Example: beef	X		C. perfringens Hobbs type 10	2 x 10⁶/gm
Sliced Ham	x		Staphylococcus	
Cold Chicken	x		Neg.For Pathogens	

13. Enviromental specimens examined: (194)

Item	Findings
Example: meat grinder	C. perfringens, Hobbs Type 10

14. Specimens from patients examined (stool, vomitus, etc.): (195)

Item	No. Persons	Findings
Example: stool	11	C. perfringens, Hobbs Type 10

15. Specimens from food handlers (stool, lesions, etc.): (196)

Item	Findings
Example: lesion	C. perfringens, Hobbs Type 10

16. Factors contributing to outbreak (check all applicable):

	Yes 1	No 2	Unk.	
1. Improper storage or holding temperature	☐	☐	☒	(197)
2. Inadequate cooking	☐	☒	☐	(198)
3. Contaminated equipment or working surfaces	☒	☐	☐	(199)
4. Food obtained from unsafe source	☐	☒	☐	(200)
5. Poor personal hygiene of food handler	☒	☐	☐	(201)
6. Other, specify	☐	☐	☒	(202)

17. Etiology: (203-204)
Pathogen Staphylococcus
Chemical
Other

Suspected ☐ 1 (205)
Confirmed ☒ 2
Unknown ☐ 3

18. Remarks: Briefly describe aspects of the investigation not covered above, such as unusual age or sex distribution; unusal circumstances leading to contamination of food, water, epidemic curve; etc. (Attach additional page if necessary)

(206-225)

Name of reporting agency: (226) Environmental Health Services Brooks AFB TX 78235
Investigating offical: V. C. Doctor, Lt Col USAF, BSC
Date of Investigation: 6 July 84

NOTE: Epidemic and Laboratory Assistance for the investigation of a foodborne outbreak is available upon request by the State Health Department to the Centers for Disease control, Atlanta, Georgia 30333

To improve national surveillance, please send a copy of this report to:

Enteric Diseases Branch
Bacterial Diseases Division
Center for Infectious Diseases
Centers for Disease Control
Atlanta, Georgia 30333

Submitted copies should include as much information as possible, but the completion of every item is not required.

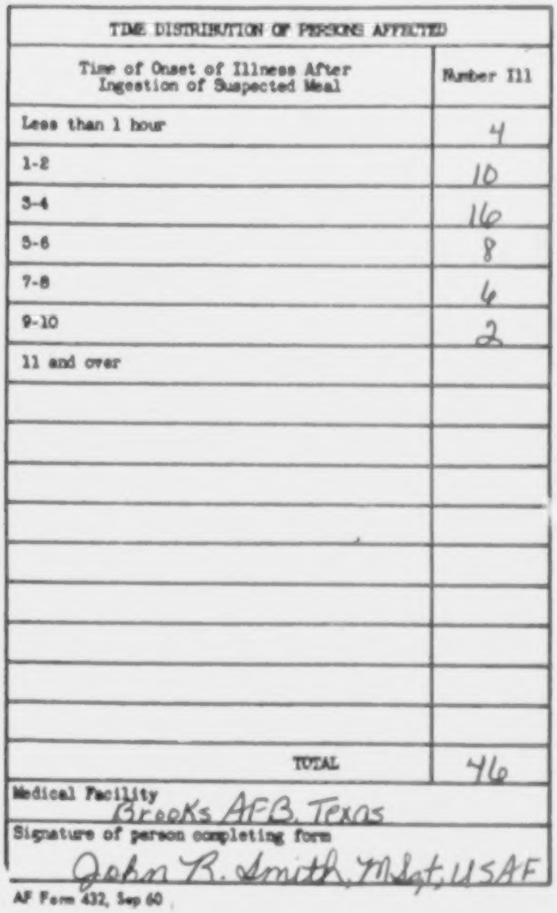
CDC 52.13 (back)
REV 9/83

Figure 4-3. DHEW PHS Form, CDC 52.13 (completed reverse).

form), which is the Department of Health and Human Services PHS Form, CDC 52.13, designed for recording your data analysis. This form will be filled out with special emphasis on section 7 (food—specific attack rates) to help determine the suspected food item. Further, you should complete and distribute this form in accordance with AFR 163-8, *Control of Foodborne Disease*.

For the second step in data collecting, you need a tabular picture of what time the symptoms of the illness began. AF Form 432 is used for this purpose, and we show it here as figure 4-4. One of these forms is used for each outbreak of foodborne illness. You can see that it is well designed for your use. All you have to do is refer to the individual case histories and enter your calculations in the righthand column of the form.

Now that you have stated the problem, collected the pertinent facts, and tabulated or charted the data, it is time to solve the problem: why did the food cause illness and what must be done to prevent its recurrence? If you analyze the data collected, you should get a partial answer. You know that staphylococcus organisms create toxins that have an average incubation period of 2 to 4 hours. Therefore, you have a definite clue to the causative agent in our foodborne illness outbreak. Knowing also that staphylococcus grows readily in high protein salads, pastries, custards, sliced meat, ham, etc., we also have some suspected carriers; ham? chicken? potato salad? The table of foods (fig. 4-2) consumed by the affected persons may supply the axact answer, or it could show as many as two or three, or more, likely suspects. The mathematical approach is the method most likely to give the quickest correct solution. First, determine the number and percent of people involved in the "food-specific attack rates" (fig. 4-2). Then, for each item of food, subtract the percent of people who became ill after eating the food from the percent of people who did not. Put this difference in the margin opposite each food item. The food that shows the largest percentage difference is usually the probable cause.



TIME DISTRIBUTION OF PERSONS AFFECTED	
Time of Onset of Illness After Ingestion of Suspected Meal	Number Ill
Less than 1 hour	4
1-2	10
3-4	16
5-6	8
7-8	6
9-10	2
11 and over	
TOTAL	46
Medical Facility Brooks AFB, Texas	
Signature of person completing form John R. Smith, MSgt, USAF	

AF Form 432, Sep 60

Figure 4-4. AF Form 432.

Of the 75 exposed persons (i.e., those who ate) providing histories, 46 people ate the potato salad and only 29 got sick. Of the 29 people who did *NOT* eat the potato salad 17 of those got ill. Based on these findings the potato salad is probably not the source of infection. The most likely suspect was the sliced ham (80 percent of those who ate sliced ham got ill. However, 11 people ate sliced ham and didn't get sick. This is not unexpected. Those who were exposed and weren't affected may not have gotten as large a dose of toxin as the ones who became ill; or that part of the food item they ate may not have contained the agent; or some data may be incorrect due to faulty memory concerning foods actually eaten. There could be other factors. So, from analysis of the data you can make the assumption that the causative agent was staphylococcus enterotoxin. This was based on the symptoms and onset data that was shown in figure 4-4. The probable carrier was sliced ham.

In order to confirm that the sliced ham was the carrier, laboratory analysis should be performed on all the items from the picnic, if available. To save time, however, you must assume that you have drawn the correct conclusion and look for the source and method of contamination. By questioning the planner of the picnic, you can find out who prepared and delivered the sliced ham. Also, by careful, diplomatic investigation you may even discover the cause of the contamination of staphylococcus in the ham. In this part of the investigation, tact and diplomacy are vital factors in producing facts. No one likes to admit carelessness or oversight, especially if it is the cause of an outbreak of illness.

Most importantly, after an investigation of this kind, use your data analysis to educate people about the dangers of foodborne illness. Thereby, future outbreaks may be prevented.

If a situation such as our picnic should occur as a result of a meal served in a dining hall, additional methods may be required to complete the investigation. These include obtaining a menu, a thorough inspection of the dining hall, interviewing and inspecting personnel who work in the establishment, and obtaining food samples, if available.

Obviously, outbreaks of foodborne illness can be costly in lost hours on the job, hospitalization costs, human suffering, and even death. In most instances, these occurrences can be prevented.

Exercise (042):

1. Why should you use AF Form 431?

2. State the purpose of AF Form 432.

3. What is the purpose of CDC 52.13?

4. From AF Form 431 (fig. 4-1), how many hours elapsed between Technical Sergeant Brown's last food intake and the time when he became ill?

5. What was the shortest incubation period reported in the food illness outbreak described in figures 4-2 and 4-3?

6. Refer to figure 4-2 and calculate the percent of people who became ill of the total number of people attending the picnic.

7. Assuming the ham caused the food illness at the picnic, what pathogen was responsible? In what block of CDC 52.13 is this data reported?

4-3. Foodhandler Training

Proper and adequate training of foodhandlers in the principles and practices of food service sanitation is of vital importance in the prevention of foodborne illness. AFR 163-8 requires that instruction in this subject be started with an abbreviated or programmed type course before the person initially begins working as a foodhandler. This training is followed with a comprehensive formal course which each foodhandler attends annually. The base environmental health officer or other qualified USAF medical service personnel will conduct the program. As an environmental medicine technician you may be asked to help present this training. Because you may be called on to assist, let's look at some of the aspects that must be considered in preparing a foodhandler's course.

043. List five publications and five sources of information other than publications to assist you in preparing a foodhandler's training course.

Sources of Information. Foodhandler's training courses should be designed to fit the needs of the foodhandlers at the facilities where they work. A good source of information is the office files. Research past inspection reports (AF Form 977, Food Facility Sanitation Check List). These reports may contain recurring problem areas in sanitation, and your plan of instruction should target these areas. Everything taught should be as required by AFR 163-8, *Control of Foodborne Disease.* This does not mean that AFR 163-8 is the only reference you should use. Other publications that can help you are:

AFP 161-22, *Sanitary Food Service, Instructor's Guide, 1969 Revision.*
AFP 161-24, *Sanitary Food Service and Personal Hygiene—Handout Sheets.*
AFR 146-7, *Food Service Managements.*
Quantity Food Sanitation by Karla Longree.

Public health authorities such as food and drug administration officials and department of agriculture personnel or state or local public health authorities are excellent sources of handouts, current information, or films. By checking with these officials you may find they are more than happy to assist you. Foodhandlers' training should be a joint continuing program in the Air Force and adjoining community.

The base film library has a listing of available films that may be ordered to assist you in specific job related areas in foodhandling. All material (films) used in training must be reviewed prior to teaching in order to evaluate its effectiveness and to familiarize the instructor for possible questions that may arise.

Other training material may be obtained from the command environmental health officer to assist you. These aids may be in the form of video tapes, handouts, or other pertinent information he or she wishes to emphasize. There may also be vital information that has been collected from other bases which may improve your training.

Remember what we're trying to do. We're trying to improve the operation at each facility. We are also trying to improve each foodhandler's performance. Information you use to meet these objectives must assist you in these tasks.

Exercises (043):

1. List five sources of information, other than publications, you may contact when planning a foodhandler's training course.

2. List five publications that can assist in the task of preparing a foodhandler's training course.

044. Identify correct methods in the presentation of instructional materials to foodhandlers.

Presentation of Material. Some bases give the same training to all foodhandlers. However, more effective training takes place when the training is geared to a particular type of facility and all the students are from that type of activity (cafeteria, dining hall, snack bar). An even more efficient breakdown may be by type of foodhandler activity (cook, waitress, baker, meatcutter, etc.). The location of training must be such that it will accommodate the attendance and lend adequate effect (sound, light, ventilation, and seating) to the training environment. Too large a facility can be as undesirable as too small a facility. Scheduling of classes must be arranged jointly with the supervisory personnel of all food service activities concerned. Remember that the facilities cannot cease operation in order for employees to attend the classes. Arrange your classes around the facility working hours. Each lesson should be presented from a well developed lesson plan. The plan should include a stated objective of what the student is expected to learn from the lesson and should be outlined to show step-by-step development of the lesson. The plan should be used as a guide and not as a word-for-word lecture.After your lesson plans are developed, you should try a "dry run" to insure self confidence and timing. Be certain that all equipment (films, slides, projectors, etc.) needed to conduct the lesson are available and in good working order. Remember, new employees are required to attend an abbreviated course immediately before employment, emphasizing basic personal hygiene, foodhandling, and sanitizing techniques. They must attend this training before being assigned duties that require contact with food or drink. Additionally, each new foodhandler must attend a formal training program within 90 days of the initial abbreviated training program. This formal training program should be given on a quarterly basis, to allow all foodhandlers to be able to attend at least one of the courses. Every foodhandler must receive annual refresher training. This annual refresher training is a very comprehensive course emphasizing personal hygiene as well as many other topics. An advanced training program will also be conducted annually for food facility supervisory personnel. Certificates of training are issued for satisfactory completion of the course (AF Form 1216, Food Handler Training Certificate). Satisfactory completion of the course requires foodhandlers to attend all classes and obtain a score of 70 percent on the end-of-course exam.

Exercises (044):

Answer each of the following exercises as true of false. If false, correct the statement.

____ 1. The most effective foodhandlers training program is one where all foodhandlers get the same training.

____ 2. Foodhandlers annually receive an abbreviated course emphasizing personal hygiene.

____ 3. For satisfactory completion of the course, foodhandlers must attend all classes and obtain a score of 70 percent.

4-4. Etiology and Control of Waterborne Diseases

Etiology and control of waterborne diseases refers to causes and prevention of diseases that are transmitted to humans through drinking contaminated water. Many of these diseases can and are spread by other means but eventually make their way into the drinking water.

045. Given terms related to waterborne diseases identify the causative agents and the preventive/control measures.

Waterborne Diseases. In this portion of your career development course we present various causes of waterborne diseases and city preventive measures. Remember, disease prevention is our primary responsibility.

Cholera. Cholera is one of the internationally quarantinable diseases, causing a severe, often fatal diarrhea. The causative organism of cholera is a bacteria, *Vibrio cholera.* Cholera can be transmitted to humans through drinking water or ingesting food contaminated with the vomitus or feces from a cholera case. The incubation period for cholera is from a few hours to 5 days, usually 2 to 3 days. Preventive measures for this disease consist of proper water purification and treatment, sanitary disposal of feces, education of the way cholera is spread, and control of all known active cases through hospitalization. Strict isolation of the patient is not necessary; however, all patients should be placed under enteric isolation. Vacinations have shown to be of little value in epidemic control or in management of contacts or cases.

Typhoid and paratyphoid fever. The infectious agents causing these systemic infectious diseases are *Salmonella typhi* and *S. paratyphi* respectively. There are presently 96 types of *Salmonella typhi* that can be distinguished. Transmission of typhoid fever or paratyphoid fever occurs when food or water contaminated with the bacteria is ingested. Depending on how much of the bacteria is consumed will determine the incubation period of the diseases, usually ranging from 1 to

3 weeks. The prevention/control measures for these diseases are again proper water purification and treatment, sanitary disposal of sewage, control of all infectives, and education of the population. There is an immunization which should be used for those people going into or living in areas where typhoid fever is endemic. This vaccine is not routinely recommended in the United States or for developed areas.

Amebiasis (sometimes referred to as amebic dysentery). The organism causing amebiasis is *Entamoeba histolytica*, a cyst forming protozoan parasite. In epidemics, amebiasis is transmitted mainly through the drinking of contaminated water which contains these cysts. Endemically, it may be spread by contaminated vegetables (perhaps those grown in "night soil" which uses human feces for fertilizer), flies, or water. Amebiasis may be transmitted among homosexuals by means of the oral-rectal route. The incubation period for this disease is a few days to years (usually 2 to 4 weeks). The prevention/control measures for amebiasis are selection of water sources not contaminated with feces containing the cysts, education of the population, and proper water treatment. Water must be disinfected (boiled) or filtered with a diatomaceous earth filter. Diatomaceous earth is effective in removing the cysts which have not been killed by disinfection. Remember, with this waterborne disease, water must be disinfected by boiling or filtered to render it safe to drink.

Giardiasis. This disease occurs worldwide, children being affected more commonly than adults. You may have an outbreak of this disease occur in your child care center at your base. These outbreaks of giardiasis happen quite frequently (as do outbreaks of hepatitis) because of children's poor sanitary habits or lack of proper hygiene by child care workers. The infectious agent causing giardiasis is again a protozoa which is transmitted as a cyst passed in stools (*giardia lamblia*). Illness will normally occur 1 to 4 weeks after exposure, with an average of 2 weeks. Routine chlorine concentrations will not kill the giardia cysts; water must be superchlorinated (5 ppm), boiled, or filtered with diatomaceous earth to make it safe for drinking. Proper selection of water sources and education of the families, personnel, and patients of institutions, especially child care centers, is especially important in preventing an outbreak of giardiasis.

Shigellosis. Sometimes called bacillary dysentery). Shigellosis is an acute bacterial disease primarily involving the large intestine. Four species of the Shigella bacteria are responsible for the transmission of shigellosis. Outbreaks are common under conditions of overcrowding and poor sanitation, such as in institutions for children, crowded camps, and mental hospitals. The Shigella organism, however, is very susceptible to environmental changes (such as heat, cold, and disinfectant), and therefore outbreaks of shigellosis do not occur as frequently as do outbreaks of giardiasis. The mode of transmission of Shigella is fecal-oral. The incubation period is 1 to 7 days, with an average of 3 days. The prevention and control for shigellosis involves proper sewage disposal, proper selection and water treatment, and treatment of infected persons.

Leptospirosis. Leptospirosis is a bacterial disease caused by several serovars (formerly sterotype) of *Leptospira interrogans*. It can be controlled at the source by identification and elimination of diseased animals. However, this is often impractical because it probably occurs worldwide in most species of wild animals and rodents as well as cattle, dogs, and swine. Rodent control in human habitations is an aid. The mode of transmission is through contact with water contaminated by urine from infected animals. Thus, wading and swimming are the primary mode of transmission, although direct contact with infected animals has caused infection. Protection of workers, such as abattoir (slaughter house or meat plant) workers, veterinarians, etc., and education of the public concerning swimming in potentially contaminated waters are the main preventive measures of transmission. Susceptibility of humans are general, and informing them of the possibility of infection is the best method of control. Vaccines have been used experimentally, but are mostly effective for local strains of the organism.

Schistosomiasis. Schistosomiasis is a helminthic disease caused by various species of the genus Schistosoma. Schistosomiasis is transmitted from humans or animals to humans through indiscriminate disposal of urine and feces. The eggs leave the body of the host in this manner and hatch in water where the larva (miracidia) seek and enter suitable fresh water snails. The importance of this intermediate host to the life cycle of the organism is one of the keys to the control of this disease. After a biological change, which takes place within the snails, free swimming larvae (cercariae) emerge from the snails and enter the susceptible host by penetration of the skin. Controls are as follows:

a. Source. Disposal of feces and urine so that eggs will not reach fresh water snails.

b. Intermediate host. Treatment of snail breeding places with molluscicides (for snail control).

c. Environment. Provision of water that is free of cercariae for drinking, bathing, and swimming. Protective measures for persons required to enter contamintated water include use of cercariae repellant or protective clothing and informing persons in local areas regarding the mode of transmission and protective measures.

Control of Waterborne Diseases. Waterborne diseases can be prevented and controlled. You must control the source of infection by proper sewage disposal, proper water treatment, and ensuring that good protected water supplies are used for potable water. Education of the general population is very important in the suppression of waterborne diseases. People need to understand the importance of proper personal hygiene, following proper food preparation techniques, and the importance of using water from safe sources for drinking, cooking, and bathing. Surveillance of waterborne diseases is another effective method of helping control them. Outbreaks of waterborne disease can be spotted early if an effective method of monitoring biostatistics is maintained at your base.

Hepatitis. Hepatitis is defined as inflamation of the liver. This inflamation may be caused by many different agents; among them are bacteria, viruses, protozoa, helminths, chemicals, and drugs. There are three basic types of hepatitis that are caused by viruses: hepatitis A, hepatitis B, and non-A/non-B hepatitis.

Hepatitis A. Hepatitis A is usually a mild disease lasting 1 to 2 weeks but can be very debilitating and may last several months. Children with hepatitis A usually are asymptomatic. However, symptoms of the disease tend to become more severe as the age of the infected individual increases. The disease is transmitted fecal-orally with an incubation period of about 15 to 50 days. The infected individual usually sheds the virus in the feces during the last half of the incubation period. This virus will normally disappear from the feces within a week after the onset of early symptoms of disease. Hepatitis A is a common problem in child care centers because of the poor hygiene of young children and because of the >90% rate of asymptomatic cases in infected children. Also, it is a problem for the military in general, because of the crowding and lack of immunity to this organism by most people in developed countries. Preventive measures for heptaitis A include ensuring proper personal hygiene (such as hand washing and the adequate disposal of feces), educating on how this disease is spread, and applying prophylatic treatment of all contacts of the infected patient with immune globulin (IG). The following are common factors in most hepatitis A outbreaks:

a. Transmission occurs prior to the onset of symptoms in the infected individual.

b. Close contacts of the patient were not given IG prophylaxis.

c. Contacts were not followed and may cause a secondary spread.

d. Ineffective disease surveillance.

e. Consultation with disease authorities was delayed until the peak of the epidemic curve had been reached.

Basic recommendations for prevention of child care center outbreaks would include:

a. Restrict child care center use to healthy, regular users which have been innoculated with IG until the outbreak has passed.

b. Give prophylactic IG to all regular users, parents, siblings, and the staff of the center.

c. Educate child care center staff, users of the facility, and parents about hepatitis A.

d. Maintain close coordination with civilian public health authorities.

e. Continue surveillance of cases and contacts and identify any secondary transmission.

Hepatitis B. Hepatitis B is a more severe disease than hepatitis A. With hepatitis B all of the body fluids (blood, saliva, semen, etc.) may contain the virus. Six to ten percent of infected adults will become carriers and that carrier state may lead to chronic active hepatitis and ultimately hepatic carcinoma. The incubation period for hepatitis B is 45 to 160 days, averaging 60 to 90 days. The people at greatest risk or developing hepatitis B in the United States are intervenous drug users and male homosexuals. In the Air Force those at greatest risk are people working in hemodialysis units at Air Force Medical Centers. Others at moderate risk in the Air Force are people who are exposed to blood or saliva, such as laboratory workers, operating room personnel, and dentists. The spouses of infected people also are at a high risk of exposure to this disease. Fortunately, the hepatitis B virus and immunity to it are readily detectable in blood. It is also possible to determine what stage of infection a hepatitis B patient is in using these tests. All donated blood is screened for hepatitis B virus, virtually eliminating transfusion associated hepatitis B. Recently a vaccine for the prevention of hepatitis B has been developed and has proven effective in its prevention. A passive immunization is available for people who are not immune and who have been exposed to hepatitis B. Hepatitis B Immune Globulin (HBIG) should be given to individuals with an exposure to the body fluids of a known hepatitis B patient, preferably within 24 hours of exposure.

Non-A/non-B hepatitis. Non-A/non-B hepatitis is the most common transfusion associated (those transmitted by blood transfusions) hepatitis. More than 90 percent of all transfusion associated hepatitis is non-A/non-B. Recently there have been many documented cases of fecal-orally transmitted non-A/non-B hepatitis. Not very much is known about this disease except that it mimics hepatitis B in symptoms and is somewhat less severe. Non-A/non-B hepatitis is probably a disease caused by several different viruses of virus-like organisms which have yet to be isolated.

Exercises (045):

1. Match the causative organism (or mode of transmission) in Column B with the disease it causes in Column A.

Column A	*Column B*
___ (1) Typhoid.	a. *Vibrio cholera.*
___ (2) Cholera.	b. *Entamoeba histolytica.*
___ (3) Giardiasis.	c. *Salmonella typhi.*
___ (4) Amebiasis.	d. Urine from infected animals.
___ (5) Shigellosis.	
___ (6) Leptospirosis.	e. *Giardia lamblia.*
___ (7) Bacillary dysentry.	f. Shigella bacteria.

2. How can waterborne diseases be prevented/controlled?

3. What are two waterborne diseases that require filtration or super chlorination for control?

4. What is a waterborne disease requiring a fresh water snail as an intermediate host for the life cycle of the pathogenic organism?

5. State the primary mode of transmission (MOT) and the major group affected for each of the following types of hepatitis:
   (a) Hepatitis A.

   (b) Hepatitis B.

   (c) Non-A/non-B hepatitis.

Airborne Diseases

RECALL THE chain of infection. Let's discuss each of its links for our study or airborne (or spread by the respiratory route) diseases. The chain consists of (1) source, (2) mode of transmission, and (3) susceptible host.

Isolation of the source is a common control method for respiratory diseases. This is accomplished by preventing well persons from coming in contact with infected patients, materials, and respiratory discharges. Various methods or degrees of isolation can be employed depending upon the severity of the disease and contributing factors. Outside of a hospital environment, isolation is not very effective in stopping the spread of respiratory diseases.

Modes of transmission (the middle link in the chain of respiratory infection) are direct contact; droplet (respiratory discharge) spread; and contact with fomites (contaminated linens, eating utensils, and other articles freshly soiled by discharges of infected persons). Some control can be achieved by avoiding crowded living and sleeping quarters and places of public gathering during seasons of high incidence of respiratory disease. Education of the public in personal hygiene is also helpful. People should be instructed in such practices as covering the mouth and nose when coughing and sneezing, practicing sanitary disposal of discharges from the mouth and nose, avoiding indiscriminate use of common utensils and drinking vessels, and washing their hands frequently.

Susceptible hosts, or the third link in the chain of respiratory diseases, are found everywhere. It could even be you or a friend of yours. Maintaining optimal general resistance through proper diet, fresh air, exercise, and general good health practices is a prime aid in preventing infection. There are vaccines available for some respiratory diseases, such as influenza, adenovirus, and measles. Health education is a useful tool for informing the susceptible host of the dangers of infection. This chapter will describe the various respiratory diseases, the Air Force Tuberculosis Detection and Control Program, and the prevention of these diseases.

5-1. Respiratory Diseases

Acute diseases of the respiratory tract are among the most common illnesses suffered by humans, and your efforts should be towards disease prevention and control.

046. Identify causative agents and preventive/control measures for respiratory diseases.

Meningitis. There are two main types of infectious meningitis: bacterial meningitis and viral meningitis.

Bacterial meningitis. Bacterial meningitis is usually caused by one of three agents: *Neisseria meningitidis, Hemophilis influenzae,* or *Streptococcus pneumoniae.* This form of meningitis is transmitted by exposure to airborne droplets from the nasopharynx of an individual. Asymptomatic carriers (those infected which do not have symptoms) are very common. This makes your job of trying to locate the source of the infection extremely difficult. There are vaccines for protection against *N. meningitidis,* and chemoprophylatic treatment can be used to protect the susceptible population during an outbreak of the disease. There is also an effective vaccine for meningitis caused by *S. pneumoniae.* Education and the control of secondary infections are effective preventive measures.

Viral or aseptic meningitis. This type of meningitis may be caused by any of a variety of viruses. Viral meningitis may mimic many other diseases, making it difficult to locate the source of the infection. Viral meningitis is rarely a fatal disease.

Streptococcal Sore Throat. Streptococcal sore throat is caused by *Streptococcus pyogenes* (group A Strep). It is transmitted by droplets from or close contact (touching, kissing, use of common drinking or eating utensils, etc.) With infected individuals. The incubation period for streptococcal sore throat is about 1 to 3 days. Certain strains produce scarlet fever. Untreated, some strains may go on to cause rheumatic heart disease, or glomerulonephritis (kidney inflammation). Most of your prevention efforts should be aimed toward preventing the complications of untreated streptococcal infection. These sequella can be prevented by early diagnosis and treatment. Both streptococcal sore throat and meningitis may be transmitted in other ways although their primary mode of transmission is by direct contact with infected individuals or their respiratory secretions.

Influenza. Influenza is a respiratory disease which has an incubation period of 1 to 3 days. It is caused by the influenzas virus which has three major subtypes: A, B, and C. The virus has two major identifying surface antigens (protein substances on the virus): hemagglutinins (H) and neuraminidase (N). This virus changes rapidly because of changes in the H and N antigens. Minor changes in the virus are referred to as an antigenic drift. Major changes are called antigenic shifts. The antigenic shifts may result in epidemic disease outbreaks. These outbreaks seem to occur with a cyclic frequency. The epidemic cycles of type A occur every 1 to 3 years and outbreaks of type B every 4 to 6 years. It is unusual for an outbreak of type C to occur. Preventive measures for influenza are education and immunization of the susceptible group. "Project Gargle" is a special program

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designed to monitor the incidence of influenza in the Air Force and detect antigenic changes with virus.

Exercises (046):

1. State a respiratory disease that may have asymptomatic carriers.

2. What does the influenza virus do to change rapidly?

3. What is a antigenic drift?

4. What are major changes in the virus called?

5. What is "Project Gargle?'

6. How can you control the spread of streptococcal sore throat infections?

047. Describe the transmission, diagnostic processes, and stages of tuberculosis.

Tuberculosis. Tuberculosis (TB) is normally a chronic, subacute disease that most commonly affects the respiratory tract but may involve other parts of the body as well. You will start by reviewing what TB *is*, and what it is not. Understanding the basic disease is critical to appreciating why you operate the TB Detection and Control Program the way you do.

Causative organisms. *Mycobacterium tuberculosis* is the organism that causes TB in humans (*Mycobacterium avium* causes TB principally in chickens and swine, while *Mycobacterium bovis* causes TB in cattle). The atypical mycobacteria closely resemble the tuberculosis mycobacteria. This organism normally does not cause disease in humans because the temperatures they require for growth and reproduction are different from normal human body temperature. Atypical mycobacteria sometimes do cause a tuberculosis-like disease in humans (generally in people with underlying serious illness) and because of this it's important to destroy these organisms. Treatment of atypical mycobacterium infections is significantly different from the treatment for disease caused by mycobacterial tuberculosis.

Mode of transmission. Tuberculosis is predominantly an airborne disease. The tuberculosis bacilli contained in contaminated droplets are coughed, sneezed, or otherwise put into the air by a person with the active disease. These droplets in their original state are normally harmless to others because the large particles fall to the ground, are filtered out by the hairs in the nose, or are removed from the larger air passages by a protective device, the "bronchial cilia."

However, the dried residues of these contaminated droplets—known as "droplet nuclei"—may remain suspended in the air for a prolonged period of time, ready to be inhaled by a susceptible individual. This means that an area that was occupied by an infectious person may remain potentially contagious even in his temporary absence. The nuclei are sufficiently small to bypass the natural defenses of individual's upper respiratory passages and to reach the alveoli (the minute air sacs of the lungs) located at the end of the "bronchial tree" (major air passages). This is where infection begins.

A single exposure to an infectious person usually does not result in infection in another individual. Normally it takes prolonged exposure, such as that occurring in classrooms among teachers and students or in the home environment among family members. Exposure to infected persons outdoors rarely leads to infection because the bacilli are rapidly killed by ultraviolet light, and normal wind currents carry the droplet nuclei out of the breathing zone.

Crowded living conditions are conducive to the spread of infections. In fact, studies of epidemics in "closed environments"—such as urban ghettos, boarding schools, and penal institutions show that virtually all susceptible persons in these environments become infected when even one actively sick person is present.

Indirect transmission of tuberculosis rarely occurs. Preventative measures are especially important for all hospital personnel working with infectious TB patients.

Tuberculosis in humans can also be caused by other mycobacterium. As little as 50 years ago, it was not unusual for children to become fatally ill or permanently deformed due to bovine tuberculosis contracted by drinking raw milk from infected cows.Tuberculin testing of dairy herds and pasteurization of milk have virtually eliminated bovine tuberculosis as a serious public health problem in the United States. However, in other parts of the world, bovine tuberculosis in humans is still a serious problem.

Stages of tuberculosis. For you to fully understand how to control TB you need to be aware of the different stages of the infection.

Primary infection. When a person inhales the tuberculosis bacilli, the organisms begin to multiply in the body very slowly. Some remain at the initial site of infection—the alveoli—while others enter the nearby lymph nodes and the bloodstream. Within a few days, the organisms are carried to most parts of the body.

During this first stage, wandering white blood cells, called phagocytes, attack and destroy the bacilli in the bloodstream. But bacilli outside the bloodstream, especially in the lungs, flourish and continue to grow. Two to ten weeks after initial infection, the individual develops a "tuberculin hypersensitivity." This is simply a sensitivity reaction in which specific white blood cells, called lymphocytes, react to a protein part of the tubercle bacillus known as "tuberculins." These same proteins are used in the so-called tuberculin skin test to detect infection in an individual. The response of the lymphocytes to tuberculin is involved in the development of a localized inflammation and the macrophage.

Macrophages engulf the bacilli and they, in turn, are surrounded by layers of other cells to form the characteristic mass of cells called a tubercle which gives tuberculosis its name. Some of the bacilli in the macrophages may die; others may remain dormant for many years.

Once this hypersensitivity reaction is established in an individual, there will be a positive reaction to a tuberculin skin test. There are 15 million people in the United States who are "tuberculin positive reactors" according to the Centers for Disease Control (CDC).

Active disease. In more than 90 percent of the people who are tuberculin positive reactors, the tubercle bacilli cause neither signs nor symptoms of illness. In those few positive reactors in whom the disease does become active, this event may occur immediately after the initial infection, or more commonly, many years later.

Primary tuberculosis can progress to active disease in several ways. In general, after the primary tubercle has healed, the lesion becomes calcified. If healing is imperfect or if the bacilli kill the cells containing them and multiply more rapidly than the host's defense can contain them, the bacilli spill out, become re-engulfed by new macrophasges, and start new tubercles as satellites to the original ones. In the process, macrophages and other tissue and blood cells that are killed form a soft, caseous (cottage cheese-like) mass that, as it disintegrates, is discharged into an adjacent air passage, leaving a cavity in the lung. The formation of the cavity in the lung is the turning point for the individual as well as for his close contacts. Astronomical numbers of disease-causing bacilli are released daily from this cavity into the air passages. Once there, they are expelled into the air, in droplet muclei and can then infect a noninfected person. Thus, the chain of infection-disease-infection is perpetuated.

High risk groups. In 1982 there were less than 26,000 active cases of tuberculosis in the United States, according to the Centers for Disease Control. In most of these individuals, the disease was an activation of an earlier latent infection. However, a few thousand of the active cases were people who were previously negative tuberculin reactors but had contracted active disease as a result of a recent exposure to infectious patients. Several thousand people who have previously been treated for tuberculosis also suffer relapses every year.

One of the most puzzling aspects of tuberculosis is why the infection exists in some, but not in others. Efforts are being made to identify those groups of individuals who run a high risk of contracting tuberculosis. It has been established that household and intimate contacts of active TB cases and hospital personnel working in TB wards are at an increased risk of developing the disease. Most Americans already infected with *M. tuberculosis* are in the older age groups and most reported active disease occurs in people over the age of 45, especially males. However, the disease often spreads more rapidly in children and infants because of their immature immune system.

Socioeconomic factors, such as low income, substandard housing, crowded living conditions, and inadequate health services contribute to the spread of any infectious disease, including tuberculosis. In the United States these conditions are particularly prevalent among the poor, regardless of race. A recent study of 55,000 American Indians in the Southwest showed that the incidence of tuberculosis in these tribes is eight times the national rate. Poverty-stricken white groups, such as migrant farm workers, are also heavily affected.

Geographically, tuberculosis is more common in large cities, especially in the inner city ghetto areas. In the past 10 years, the case rate in cities with populations greater than 250,000 has been double that for the rest of the country.

Scientist speculate that tuberculosis reactivates when a person's immune system becomes impaired by disease or for other reasons. That may be who certain medical conditions are frequently associated with tuberculosis. These include diabetes, immune deficiency diseases (AIDS), and chronic lung diseases, such as silicosis and asbestosis. Alcoholics also have an unusually high rate of tuberculosis.

Symptoms and diagnosis. The vast majority of people with a primary tuberculosis infection do not have any symptoms. Occasionally, there is a slight fever, a skin reaction, or a general feeling of discomfort that marks the development of tuberculin hypersensitivity. These symptoms usually disappear and the infection enters a dormant stage.

The active stage of tuberculosis is normally marked by an insidious onset with vague symptoms that may go unnoticed by the individual. These may include fatigue, nervous irritability, weight loss, fever, chilliness, night sweats, loss of appetite, or a "cold" that hangs on. Coughing is uncommnon in early phases of the disease. Two severe symptoms—hemoptysis (spitting up of blood or blood stained sputum) and chest pains—are surprisingly uncommon. Shortness of breath does not usually occur until the lungs are extensively damaged.

The methods used by physicians to diagnose tuberculosis include a history of symptoms, physical signs, microscopic examination of the patient's sputum, chest x ray, and tuberculin skin testing. The sputum of the patient is studied primarily to isolate the tubercle bacilli and also to distinguish *Mycobacterium tuberculosis* from other mycobacteria, which cause diseases that are difficult to differentiate from tuberculosis.

Common sites/detection of infection. Close to 80 percent of the newly diagnosed tuberculosis patients in the United States first come to physicians or health workers because of symptoms. One of the major goals in controlling tuberculosis is to detect such people before they infect others. This is where the tuberculin skin test (TST) plays a valuable role.

Several tuberculin tests are available, but the Mantoux test is probably the most satisfactory and widely used. In this procedure, the purified proteins (tuberculines) isolated from the tubercle bacilli are injected intradermally (between the layers of the skin). If the person has been infected with tubercle bacilli previously, a sensitivity reaction occurs within 48 to 72 hours, resulting in a hard, red, raised spot at the injection site. When the purified protein derivative (PPD) test is used, the size of the hardened area is significant. An area of 10 millimeters (about 1/2 inch) of greater in diameter indicates a positive reaction.

The tuberculin test can also be performed with multiple puncture techniques such as the tine test. The major use of this test is in large scale screening programs. In the multiple puncture tests the purified protein derivative is still placed intradermally, but in an unmeasured amount so the size of a reaction is not measured. The fact that a reaction occurs should result in our administering a PPD.

The tuberculin tests have certain limitations. Most importantly, the reaction is essentially the same in a person who is merely infected with tubercle bacilli and a person who has active disease. When a TB skin test reaction is positive, a chest x ray is required to find out if the person has active disease. If a physician finds a positive reaction, he may order a chest x ray to find out if the person has the active disease.

False positive and false negative reactions sometimes occur in people infected with atypical mycobacteria. False negative reactions can also occur due to a variety of other circumstances, including improper test methods, when the individual has an underlying immunosuppressive disease, has been vaccinated recently with a live virus vaccine, is on immunosuppressive drugs, or when a person has active tuberculosis.

Through a combination of selective tuberculin skin testing, infected persons are detected and treated. The relentless cycle of infection-disease-infection is being broken.

Exercises (047):

1. What is TB?

2. What is the causative organism for TB in humans?

3. Why are you concerned with atypical mycobacterium?

4. What is the primary mode of entry for the tubercle bacillus in humans in the United States?

5. What usually happens in the first stage (primary) of TB infection?

6. What are some symptoms of active TB?

7. What four criteria are required for the diagnosis of the clinical disease?

5-2. Tuberculosis Detection and Control Program

Nobody gets tuberculosis anymore, right? *Wrong.* Three million people a year die of TB. Ten to 12 million people, in any given year, are sick with TB. Fifty to 100 million people each year (16 million of those are Americans) become newly infected with TBAs an environmental medicine specialist, you will play an extremely important role in helping people not get sick with TB. The Air Force's Tuberculosis Detection and Control Program is a direct extention of the programs you can find at every country health department in the United States. We (the EHS) conduct the program for the Air Force.

048. Describe the appropriate management of individuals monitored on the TB Detection and Control Program.

Chemotherapy. Tyberculosis is largely a preventable disease. In the United States, prevention has focused on identifying infected individuals—especially those who run the highest risk of developing active disease—and treating them before they become ill.

Chemoprophylaxis (the use of drugs to prevent disease) is primarily accomplished with isoniazid (INH) which is taken daily for 1 year. The INH and the other medications used to treat TB act to destroy or render "harmless" the bacteria that cause this disease. A multiple drug regimen is not necessary in preventive treatment since there are relatively few tubercle bacilli present in an infected person, in contrast to the hundreds of thousands of organisms in a person with the active disease.

Most people who have a positive tuberculin skin test are at some risk of developing the active disease. Public health officials highly recommend preventive therapy for six groups of individuals who run the highest risk of contracting the active disease. They are (1) household contacts of people with the active disease; (2) people who have recently shown a conversion in their tuberulin skin test from negative to positive (indicating recent infection); (3) persons with previously known tuberculosis, now inactive, who have not had adequate chemotherapy; (4) positive tuberculin reactors with abnormal lung findings in their chest x ray (calcified granulomas); (5) positive tuberculin reactors less than 35 years old; and (6) people with a positive tuberculin test who have certain underlying medical conditions (such as diabetes, leukemia, or Hodgkin's disease), those who have had a gastroectomy, or who are receiving immunosuppressive drugs.

People undergoing chemoprophylaxis should be supervised by a physician because of the possibility of developing isoniazid-related liver disease (chemical hepatitis). Persons over 35 years of age are at a greater risk of developing hepatitis from the INH medication.

Taken as directed by a physician, isoniazid is 90 percent effective in preventing the development of active TB. One of the major problems has been motivating people to continue taking the drug for the required length of time when they feel fine.

INH is the most effective single drug in the treatment and prevention of TB. Adverse reaction to this medication may result in chemiclly induced hepatitis. The recommended adult treatment of INH is 10 mg per kg of body weight taken orally, not to exceed the maximum daily adult dose (300 mg day). Pyridoxine is a form of vitamin B6 that may be taken with INH to counteract the INH's interference with a persons intestine being able to absorb the adequate amounts of the vitamin usually available in normal diets. Not all physicians prescribe the pyridoxine. If the pyriodoxine is prescribed, then the usual recommended dose for adults and children is 50 mg per day taken orally.

INH and other medications are used for the treatment of the active disease. The discovery of specific drugs to treat tuberculosis, beginning with the antibiotic streptomycin in 1944, marked a new era in controlling this disease. Prolonged bed rest in sanitariums is no longer generally necessary. Although a patient may be treated in a hospital, he may be discharged safely possibly within a few weeks—when TB organisms can no longer be detected in the sputum. One problem with drug therapy is the likelihood that some bacilli may be resistant to a particular drug. To reduce the possibility that these bacilli might survive a one-drug regimen, doctors usually prescribe combinations of two or more antituberculosis drugs.

Isoniazid, streptomycin, rifampin, ethambutol, and para-aminosalicylic acid are the primary medicines used in the treatment of tuberculosis. Of these, isoniazid is probably the best and most valuable of the currently available drugs. It is easy to administer (by mouth), it has few side effects, and it is inexpensive. The combination of isoniazid and one of the other drugs, such as ethambutol or rifampin, has had excellent results in the treatment of active tuberculosis patients.

Today, the principal cause for failure of therapy is the failure of patients to take medications as prescribed or to take them for an adequate period of time.

INH patient followup. Initially, once the physician, physician's assistant, or nurse practitioner places an individual on INH chemoprophylaxsis it is your responsibility to ensure that the patient is educated and monitored monthly while on the program. You should counsel the patient on the proper ways of taking the medication and about the possible signs and symptoms of adverse reactions to the INH medication. Drug induced hepatitis, (inflammation of the liver caused by a drug) is of utmost concern. Such symptoms as brownish urine, clay-colored stool, yellow eyes or skin, loss of appetite, fatigue, and malise (i.e., feeling of bodily discomfort) may mean the patient is having this adverse reaction to the INH chemoprophylaxis. Other adverse reactions to INH are rash, arthritis, and drug fever. They should notify the environmental health section immediately if symptoms occur, so that you can arrange for physical evaluation. Any of these symptoms should be reason for concern, and the patient should be evaluated by a physician. Monthly liver function tests (SGOT/SGPT) must be accomplished on individuals taking INH. There are a number of factors that can cause elevated SGOT test results (e.g., foods, coffee and alcohol). If these liver function evaluations are greater than three times the baseline or normal results, the patient should be monitored closely at frequent intervals for drug reaction signs and symptoms and liver function tests.

Routine monthly followup would include an interview for indication of adverse reactions to the INH, a liver function test, and the INH (and Pyridoxine) refill.

The INH prescription refill should provide only 1 month's supply at a time. There are exceptions to this (such as PCS/TDY to a remote base and leave) where up to 11 months of INH and Pyridoxine may be given to the patient,but this can only be done if the capability for the medical monitoring (liver function tests, physician, etc) exists at the gaining facility. Before the patient leaves (PCS, TDY, etc.) he or she is counseled concerning the importance of continuing medical supervision and is "stabilized" on therapy. By "stabilized" we mean that you insure that the patient has not experienced any adverse reactions to INH and his or her liver function tests are within normal limits. The patient should be stabilized for at least 30 days prior to reassignment.

Flying personnel on the TB Detection and Control Program are managed by the flight surgeon's office. Flying personnel have the same requirements as others on the program except they are on flying status. These personnel must be grounded fro 7 days when initially started on INH medication and then given a waiver to fly if they are considered stable on the therapy. Remember, the patient may be symptomatic *without* elevated liver function tests or asymptomatic with elevated liver function test. In either of the above situations the patient should be evaluated by a physician.

Medication interruption. If the INH is discontinued (by the doctor or patient) prior to the full 1 year treatment, patients should receive chest x ray once a year for 3 years. Also, a chest x ray once a year for 3 years is the alternative you should use to monitor for patients not placed on the chemoprophylaxis. Chest x rays can detect developing TB in patients who were discontinued or for some reason not started on preventative medication.

Exercises (048):

1. What medication is indicated for those at an increased risk for developing active TB?

2. When should bacteriologicl studies (sputum tests) be ordered on an individual?

3. Who is considered for INH chemoprophylaxsis?

4. What action should be taken if the patients liver function test is more than three times as much as the baseline results?

049. Describe the administrative requirements for the TB Detection and Control Program.

Administrative Requiremenst. An AF Form 2453, Tuberculosis Detection and Control Data is completed on each person requiring follow-up. This form may be held in a suspense file in environmental health service until treatment is completed, provided the patient's treatment record is identified to alert physicians that the person is on INH chemotherapy. On the AF Form 2453, you must annotate the results of the baseline and monthly liver function tests, baseline chest x rays, etc. A complete and accurate record is kept in the AF Form 2100 series treatment record of all patient interviews, physician evaluations, medication refills, etc. Anytime you are making entries on the SF 600, Health Record—Chronological Board of Medical Care, in the patient's medical record, use a problem oriented medical record entry system, such as the Subjective, Objective, Assessment, and Plan (SOAP) format. This form of documenting is required by the Joint Commission for the Accreditation for Hospitals (JCAH) manual. Annotate the SF 600 each time the individual is seen in environmental health service.

Flag AF Form 2100 series, treatment records, when the patient is initially placed on INH chemotherapy. This "flag" alerts the medical record section that the patient must report to environmental health services prior to PCS/TDY and upon arrival to his or her new duty station.

The following situations would be cause for a person to be closely monitored while on INH chemotherapy:

a. Currently using any other medications on a long term basis.

b. Taking diphenylhydantoin (medication for epilepsy).

c. Those who use alcohol daily.

d. Have previously discontinued INH because of suspected adverse reaction.

e. Suspected to have chronic liver disease.

Pregnant or breast feeding mothers should not be recommended for chemoprophylaxis. If they are already on INH prior to the pregnancy you should recommend that the medication be discontinued, then restarted (for 1 year) after breast feeding. Always remember, the physician will make the final determination concerning what the appropriate medical treatment of the patient should be. He or she may at times ask you what your recommendations are, in which case you should refer to the regulation regarding the problem (i.e., TB, AFR 161-29) and the current *Control of Communicable Diseases in Man,* published by the American Public Health Association, etc. Again, remember the physician will make the final decision for the treatment of the patient. Refer the patient to the doctor anytime you detect something that you feel requires a medical evaluation. Ensure that the doctor is aware of these circumstances prior to determination of the patient's disposition.

Bacille Calmette-Guerin Vaccinations. Although isoniazid is preferred in the United States as a means of preventing tuberculosis, the BCG vaccination is widely used in many parts of the world.

In 1922, the first live vaccine against tuberculosis, known as Bacille Calmette-Guerin (BCG), was tested in humans. This vaccine was prepared from a strain of *Myacobacterium bovis* by two French scientists, Albert Calmette and Camille Guerin, who were able to weaken the virulence of the original organisms over a period of many years. Today, all existing BCG vaccines are derived from this attenuated strain.

The rationale behind BCG vaccination is based on the finding that the response to a first infection with the tubercle bacillus differs from the response to a subsequent infection. The second infection is much more easily held in check by the body than the first infection—which often progresses directly to active tuberculosis—and so it appears that the host acquires some immunity from the primary infection.

The aim of BCG vaccination is to prevent the potentially harmful natural primary infection with a harmless, artificial, primary infection. The hope is that this will enhance resistance to a subsequent virulent infection. Chemoprophylaxis, on the other hand, is geared mainly to those individuals who have already been infected. BCG has been shown to vary in its ability to protect a person from being 10 percent effective to 60 percent effective. While its relative ineffectiveness is the reason it is not used in the United States, most experts agree that BCG vaccination is of major value in areas of the world (particularly developing countries) where the incidence of tuberculosis infection is still high. Recently, in 38 African and Asian countries, more than 31 million vaccinations were given primarily to newborn infants and school children. You may interview patients who have received this vaccination. Following this vaccination most individuals will convert to TST positive. However, after about 10 years, most will revert back to negative. It is impossible to predict what the TST will be for BCG vaccinated persons, therefore the vaccinated patient should be treated as any other positive reactor. A negative or doubtful result would indicate that the patient should be followed as any nonvaccinated individual with the same reaction.

Annual Reporting. Compiling the annual report can be easy if you maintain accurate data monthly. See figure 5-1 for a suggested monthly record keeping report. The data is obtained from the immunization clinic (and any other clinic doing TST's) monthly. The annual report needs to be submitted to your major command annually in the month of January. Refer to AFR 161-29 for the specific requirements for the annual report.

Bear in mind the importance of adequate followup on patients taking tuberculin medication. For INH patients the main concern is the patient's developing an adverse reaction—especially drug-induced hepatitis. There are other adverse reactions, but we monitor patients mainly to ensure that their liver is still able to function as it should.

Many people no longer regard TB as an urgent health problem. However, even today, TB is the second leading cause of death from infectious disease in the United States and represents a massive economic burden to individuals and society. As environmental health specialists you spend a respectable amount of your time involved in the TB Detection and Control Program. It is time *well* spent.

Exercises (049):

1. Where is the AF Form 2453, Tuberculosis Detection and Control Data, maintained while a patient is on chemotherapy?

2. What should happen if a BCG vaccinated person is positive IPPD?

3. When is the annual TB report submitted to major command?

5-3. Respiratory Disease Prevention

The prevention of respiratory diseases is often very difficult for the following reasons (1) the mobility of our population; (2) the existence of asymptomatic carriers (bacterial meningitis); (3) rapidly changing viruses

TO: SGPM

The following information is submitted for the month of ____________ in accordance with AFR 161-29.

	US MILITARY FLYER/NON FLYER	US NON-MILITARY ADULT 10-19	US TOTAL MIL/NON MIL	TOTAL FOREIGN NATIONAL
1. No. of persons receiving one or more tuberculin skin tests.				
2. No. of persons determined negative (only reactions which were read as negative).				
3. No. of persons determined to be PPD Positive.				
4. No. of persons determined to be doubtful.				
5. No. of persons who failed to return to have test read.				

6. Identification of persons with positive TB skin tests:

	NAME	STATUS/RANK	SSAN	PHONE	DATE	EMS DISP
a.						
b.						
c.						
d.						
e.						
f.						

____
Signature of Person Completing Form

Figure 5-1. Suggested format for monthly TB data log.

(influenza); (4) limited number of vaccines; and (5) the limited acceptance of immunization programs.

050. Describe how airborne diseases may be controlled.

Preventing respiratory diseases is not always possible. However, you can control the spread of airborne diseases by instituting the following fundamental control measures:

a. Avoiding overcrowded conditions (at home and work).

b. Educating the susceptible population about how respiratory diseases are caught, spread, and controlled.

c. Maintaining surveillance of the population through biostatistics and effective disease reporting; screening and testing of the population; and searching for contacts of infectious diseases.

d. Isolating and treating infected individuals to control the sources of the infection.

e. Vaccinating the susceptible population when possible, thereby breaking the chain of infection.

f. Instituting chemoprophylatic treatment where appropriate.

These are just a few basic measures geared to the control of respiratory infections. Certain diseases may require different control measures (other than the ones listed above) in order to prevent or control an outbreak.

Respiratory diseases can definitely have an adverse effect on the Air Force mission. You are essential in supporting our mission by advising and recommending effective prevention, surveillance, and control programs for these diseases.

Exercises (050):

1. Cite ways in which you can maintain surveillance of a population to detect and control the spread of respiratory diseases.

2. Why are respiratory diseases often difficult to prevent?

3. Cite four ways to control the transmission of respiratory diseases.

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Sexually Transmitted Diseases

SEXUALLY transmittable disease (STD), sometimes referred to as "venereal disease" or VD (after Venus, the Goddess of Love), is spreading more rapidly than all other communicable diseases combined.

STD refers to several serious contagious diseases, usually transmitted by sexual contact. Sexually active people face an increased risk of infection since partners can have a STD, not know it, and infect others with it. The symptoms of a STD may not appear for some time, may not be recognized, or may be slight until severe complications set in.

In most cases, STDs can be easily diagnosed and treated without harm to anyone. This, however, requires knowledge about the diseases, early medical care, and immediate notification of persons exposed to the infection. Fortunately, STDs can be prevented. Some of the prevention methods will also be covered in this chapter.

6-1. Major Sexually Transmitted Diseases

In this chapter we will describe the major sexually transmitted diseases, how to do an STD interview, and the Air Force STD program. Additionally, you will notice that we have included a review of the human reproductive system. This was necessary because of the nature of the subject matter we will be covering.

051. Identify parts of the human reproductive systems and cite signs or symptoms, transmission, and complications of gonorrhea.

The Human Reproductive System. The female organs are almost entirely within the body (fig. 6-1). The principal parts that are visible from the outside are the labia. These surround the opening of the vagina, which is a passage made up of many folds of mucous tissue that provide considerable elasticity. The vagina has a moist protective lining called mucous membranes because of its susceptibility to the outside world. For example, the mouth is constantly exposed to environmental elements and therefore has mucous membranes, as does the throat. Mucous membranes in the vagina constantly shed old cells an replace them with new ones. This process is noticeable, in most women, as a slight clear or white discharge. This discharge becomes heavier at different times but is perfectly normal unless it produces an itching sensation or has a foul odor. At the innermost part of the vagina is the cervix which is the mouth of the uterus (womb). The uterus is a pear-shaped organ composed of interlacing muscle fibers with a special glandular membrane lining. From each side of the top of the uterus extend two passageways known as the fallopian tubes which connect with the ovaries. Notice that the bladder is located in front of the uterus and that the urinary tract is not as intimately connected with the sex apparatus as is the case in the male.

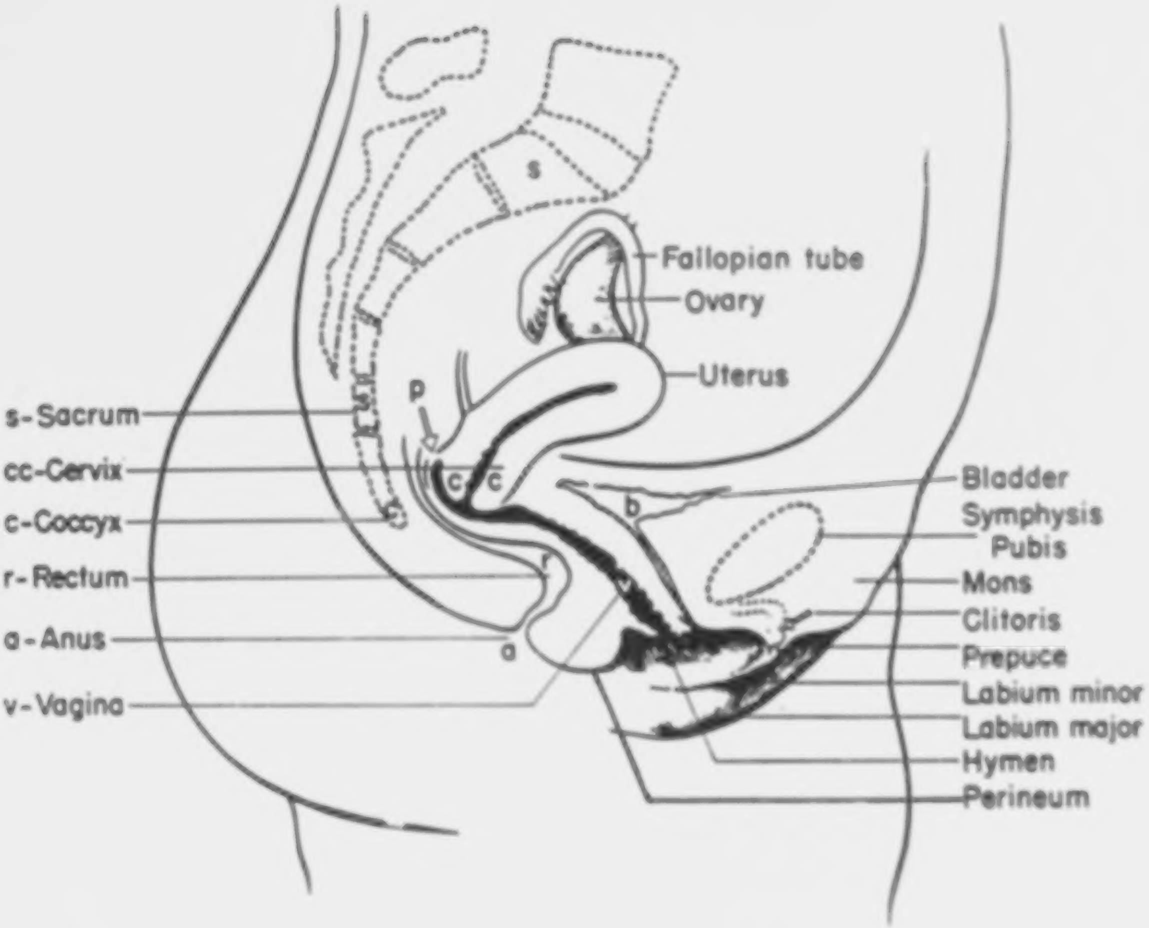
The sex organs of the male are partly on the outside and partly on the inside of the body (fig. 6-2). The parts that are visible from the outside are the penis and the scrotum. Inside the scrotum are the testicles and the epididymis. The testicle is the organ in which the life-giving sperm are produced. When these cells mature they pass into the coils of the epididymis where they further develop. They then pass through the vas deferens in the spermatic cord to the urethra. The urethra is a tube that extends from the bladder through the penis. The urethra, as other parts of the body that come in contact with external constituents, is lined with mucous membranes.

The male urinates and ejaculates semen (although not simultaneously) through the opening at the tip of the penis called the urethral or urinary meatus. Sexually transmitted diseases can enter the body through the meatus or the skin of the scrotum or penis.

Gonorrhea. Gonorrhea—the most common STD—is spread from one individual to another by intimate vaginal, oral, or rectal contact with an infected person. It is caused by the bacteria *Neisseria gonorrhoeae* (gonococcus) which attacks mucous membranes of the penis, vagina, rectum, urethra or throat. The gonococcus quickly dies in air; thus, it is almost impossible to catch gonorrhea from objects that have been used by an infected person.

The gonococcus travels from the mucous membranes of the infected partner to the uninfected partner's mucus membrane. This bacteria may not always infect the uninfected partner. They often die during the transfer, and therefore chances of catching gonorrhea are about 50 percent in any single exposure. However, repeated sexual intercourse with the infected person greatly increases the chances of developing the infection.

Uncomplicated gonorrhea in the male. Common terms often used to define penile gonorrhea, such as the drip, burn, and clap, actually explain how the disease affects the penis. When the gonorrhea germ enters the penis, the body responds with white blood cells (from the blood) that attack and consume most of the bacteria. However, the germs quickly overpower the body's natural defenses. Usually 3 to 7 days after contact, gonorrhea causes a thick, whitish-yellow discharge of pus (drip) from the penis, consisting of dead urethral cells, bacteria, and white blood cells. The meatus becomes swollen, causing the lips to come closer together (clap). Because of this infection urination can be difficult and mildly to severely painful (burn). Sometimes



FEMALE ORGANS, SIDE VIEW

Figure 6-1. Female reproductive system.

a drip without burning, or burning without a drip, will occur. Either or both should be reported to a physician.

More often today, some men do not develop symptoms of infection. These "asymptomatic" males do not seek medical care and are a major factor in complicated and reinfected cases of gonorrhea. Untreated penile gonorrhea can cause painful inflammation of the prostate gland, scarred tissue inside the penis, and intense irritation and swelling of the testicles, leading to sterility.

Uncomplicated gonorrhea in the female. The gonococcus infects the cervix, uterus and/or fallopian tubes of women. The germ cannot normally affect the vagina of a woman after puberty because the lining of the vagina and vulva becomes thicker due to hormone changes and is difficult for the gonococcus to penetrate. The normal flora of the vagina also make it an unattractive "home" for the gonococcus. Gonococcal infections in women may produce an unusual discharge from the mucous membranes of the infected genitals. Women normally have a vaginal discharge (mucous) that occurs in excess during sexual excitement, during ovulation, a few days before menses, and during pregnancy. Therefore, a discharge because of infection may initially go unnoticed. Occasionally, a burning sensation may occur during urination. Approximately 80 percent of cases in women are asymptomatic; therefore, it's very important for men with symptoms to notify their female sexual partners and for women to request an examination for gonorrhea if they believe they've been exposed.

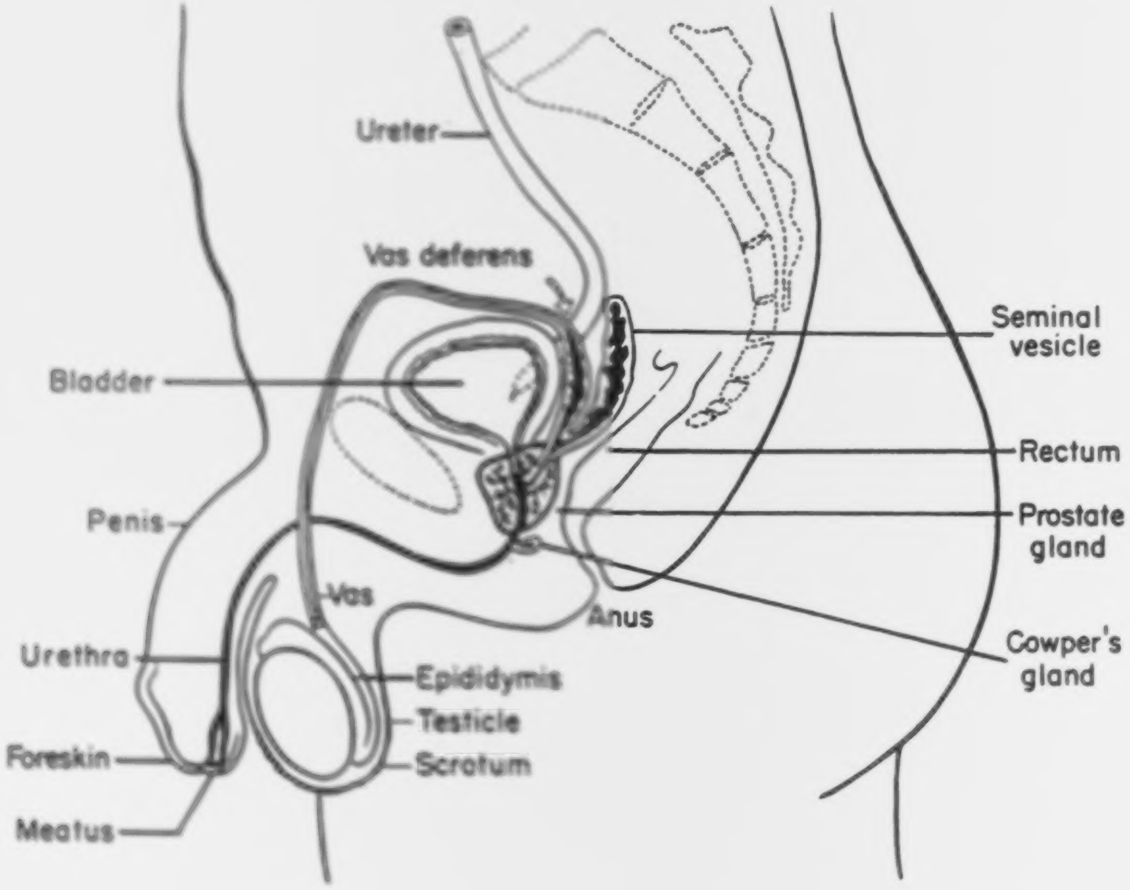
Untreated, gonorrhea in women can become extremely serious, leading to pelvic inflammatory disease (PID) and the risk of passing the disease to the newborn during birth. PID can cause sterility (inability to become pregnant) or an abnormal pregnancy in the tubes.

Nongenital gonorrhea. If the site of infection is not genital, it is likely that symptoms may go unnoticed in both sexes. Rectal gonorrhea, caused by anal penetration, and pharyngeal gonorrhea, caused by practicing fellatio (oral penile penetration) are examples of the types of uncomplicated nongenital gonorrhea. When symptoms are present, in cases of rectal gonorrhea, they include a rectal mucous discharge, intense rectal irritation, a feeling of incomplete evacuation after defecation, and burning pain during defecation or anal intercourse. Rectal contacts of persons with penile gonorrhea should receive treatment since medical examination and diagnostic cultures may not detect rectal gonorrhea. Pharyngeal gonorrhea (oral gonorrhea) infects the throat. If symptoms are noted, they include a mild to severe sore throat, fever, and chills.

Complications. Gonorrhea is a serious disease. If left untreated it may produce some serious complications in both the male and female.

Male complications. If untreated, the symptoms of gonorrhea will eventually disappear, but the individual is still infected with the disease. The bacteria travels up the urethra and infects other organs in the reproductive system, such as the prostate gland. Pain or urination becomes more severe and is felt in the whole penis, not just the meatus. Eventually, an abcess forms in the prostate gland causing a feeling of heat, pain, or swelling in the lower pelvis or around the anus, severe pain on moving the bowels, and high fever. The enlarged, infected prostate presses on the bladder, making it difficult or impossible to urinate. The abscess eventually breaks down into the urethra or rectum, releasing pus. Most men, however, do not develop a prostatic abcess and the untreated disease can continue for a long time causing only minor symptoms.

In about 20 percent of men who remain untreated for longer than a month, the bacteria spread down the



MALE ORGANS, SIDE VIEW

Figure 6-2. Male reproductive system.

vas deferens (tube from prostate to testicles) and reach the epididymis on the back of one or both of the testicles, causing gonococcal epididymitis. Epididymitis, which occurs more commonly on the left side, causes pain in the groin, a heavy sensation in the affected testicle, and the formation of a small, hard, painful swelling at the bottom of the testicle. The overlying skin of the scrotum becomes red, hot, and painful.. Even when treated, gonococcal epididymitis leaves scar tissue which closes off the passage of sperm from the affected testicle. Since epididymitis is usually restricted to only one testicle, even such advanced gonococcal infection does not often lead to sterility; however, if the infection is left untreated, both testicles become involved and the man is left sterile.

Early gonococcal urethritis is often painful, uncomfortable, and obvious, which leads many men to seek early medical treatment. Modern antibiotics are rapidly effective and completely prevent the occurrence of complications or permanent effects such as sterility. Thus, complications of gonorrhea in the male are extremely rare today and even when treatment is delayed, total recovery is the rule.

Female complications. Complications can also occur in the female if the gonococcal infection is not treated. Infective heavy vaginal discharge or menstrual blood may be manually transferred to the rectum and result in infection. Gonococcal infection of the rectum, called gonococcal proctitis, develop in 40 to 60 percent of women who have genital gonorrhea.

Gonorrheal pelvic inflammatory disease (PID) is a serious complication that may occur in the female. Uncomplicated gonorrhea does not produce noticeable symptoms in most women and the infection is often not treated. If treatment is delayed for more than 8 to 10 weeks, the bacteria may make their way into the uterus. This may be the start of the most common complication of gonorrhea in women, PID, which occurs with about 50 percent of the untreated cases of uncomplicated gonorrhea. During menstruation when the bacteria can multiply rapidly in the dead cells and discharged blood of the uterus lining, they spread quickly up the sides of the uterus and attack the inner walls of the fallopian tubes. This infection of the fallopian tubes is called salpingitis (fig. 6-3). The infection can travel out of the fallopian tubes and invade the pelvic cavity. When this occurs the pelvic tissues become swollen and inflamed. This is called pelvic inflammatory disease. The infection may block the open ends of the fallopian tubes (next to the ovaries), allowing pus to collect in the tubes. As infection builds, the size of the tubes becomes grossly enlarged. The fallopian tubes quite frequently remain blocked by scar tissue, leaving the woman sterile. A woman with gonococcal PID may experience one or more of the following symptoms: lower abdominal pain, pelvic tenderness, elevated temperature, dysuria (painful or difficult urination), vaginal discharge, nausea, and vomiting.

Although antibiotic treatment given early cured PID and often prevents permanent blockage of the fallopian tubes, treatment cannot repair whatever damage has already occurred. In other words, the infection is cured but the pelvic organs never fully recover.

In most women, damage to the pelvic organs caused by the PID causes no symptoms; but some women have chronic mild to moderate lower abdominal pain which may worsen during menstruation, sexual intercourse, fatigue, or constipation. Some women who suffer from

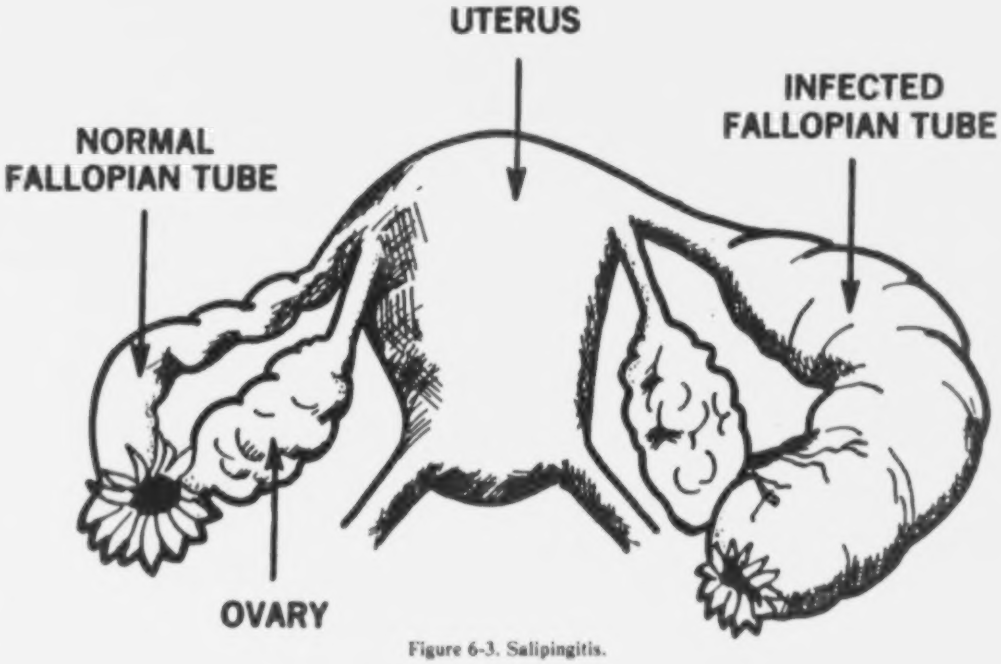


Figure 6-3. Salipingitis.

pelvic residue experience repeated attacks of severe, lower abdominal pain and may ultimately have to have a hysterectomy (removal of the uterus and tubes) for relief.

Other complications. Some people who have an untreated gonorrheal infection for more than a few weeks develop gonococcal septicemia. This condition exists when the gonorrhea germ leaves the genital area and/or anal canal and enters the bloodstream. Another term used to explain this spread of gonorrhea is "disseminated gonorrhea." Gonococcal speticemia, although rare, mostly occurs in women and homosexual males who are more likely to have the disease for a long time without any noticeable symptoms. The presence of the gonococcus bacteria in the bloodstream can cause symptoms such as fever, malaise, loss of appetite, and more seriously, arthritis and dermatitis. Eventually, the gonorrheal bacteria may invade the heart, liver, and central nervous system. However, this extent is extremely rare. Only a few cases have been reported in the past three decades.

Gonorrhea may enter a newborn's eyes as it passes through the birth canal of the infected mother. This eye infection of the newborn is called gonococcal opthalmalia neonatorum. One or both of the newborn's eyes may be infected with symptoms occurring within 48 hours of birth. The newborn's eyes become red, swollen, and painful, ejecting pus between the eyelids which may be swollen shut.

Exercises (051):

1. What is the moist protective lining present in certain parts of the body that continuously sheds old cells and replaces them with others?

2. How do sexually transmitted diseases enter the male body?

3. In the woman's body where does the gonococcus initially infect?

4. Cite symptoms of disseminated gonorrhea.

5. If gonorrhea is left untreated, approximately, approximately how long will it take for pelvic inflammatory disease to occur?

6. What may result in the female if PID is left untreated?

052. State how gonococcal infections are diagnosed and treated.

Diagnosis. Gonorrhea may be effectively cured, leaving little damage to the body, if properly diagnosed and treated soon after infection. However, treatment does not cause immunity, and the individual can be reinfected. Individuals who treat themselves with leftover antibiotics or black-marketed antibiotics may cause the symptoms to disappear, but the disease will persist in the body. Self-treatment is dangerous (because it is mostly ineffective) and can cause mutant, antibiotic-resistant strains and widespread infections.

Diagnosis for gonorrhea includes history of signs and symptoms and identification of *Neisseria gonorrhoeae* in body secretions. In males with the classical urethral discharge, the presence of "gram-negative intracellular diplococci" (GNID) in stained films of the discharge is good grounds upon which to base the diagnosis. This procedure is called a smear and can also be used for identifying *N. gonorrhoeae* in other parts of the body that produce pus cells in the symptomatic discharge. Although the smear is sufficient in identifying the presence of gonorrhea in symptomatic males, cultures are often necessary to confirm diagnosis (i.e., asymptomatic male/female). Cultures from the throat and anal secretions should be routinely done on patients in whom gonorrhea infection is suspected.

Cultures are used for diagnosis in all suspected cases and in screening programs. Routine culture sites for females include the endocervical and rectal areas (never the vaginal area in adult females). If no *N. gonorrhoeae* is identified after 48 hours the culture is considered negative.

Treatment. Active cases should be treated in accordance with current Centers for Disease Control (CDC) guidelines. Followup test of cure (TOC) cultures should be taken from the infected site 3 to 10 days following treatment (3 to 7 days for penicillin resistant strains; 7 to 10 days for penicillin sensitive strains). The increased incidence of treatment resistant strains and recognition of reinfection or serious complications of gonococcal infections make the test of cure examination a vital and essential phase of followup on gonorrhea cases. Since resistant strains of the infection, such as Penicillinase-Producing Neisseria Gonorrhea, are a major cause of treatment failure, all TOC isolates should be tested for penicillinase production.

In recent years more and more cases have been reported in which the gonococcus is resistant to treatment with penicillin. This resistant strain, called Penicillinase-Producing Neisseria Gonorrhea (PPNG), produces beta lactamase, an enzyme which makes it totally resistant to penicillin. This strain of gonorrhea is more widespread in large cities on the East and West coasts of the United States and in most Asian countries. Military personnel, because of assignments to endemic areas, are at increasing risk of developing PPNG. All test of cure cultures identified as positive must be tested for PPNG. Patients with PPNG and their sexual partners should be treated and follow up in accordance with current CDC guidelines.

All patients treated fro gonorrhea should have a serologic test for syphilis prior to treatment for gonorrhea and, if treated with any regimen other than 4.8 million units of aqueous procaine penicillin G, should have monthly serologies for 4 months following treatments. Patients with gonorrhea whose serologic test for syphilis is positive should be appropriately treated for syphilis.

Exercises (052):

Place a T in front of the correct statements. Explain why others are false.

____ 1. The presence of "Gram-negative intracellular diplococci" in stained films of urethral discharge confirms gonococcal infections in the asymptomatic male.

____ 2. Positive results on a test of cure (TOC) culture could mean the individual has been reinfected or has a resistant strain to the antibiotic used in treatment.

____ 3. An individual with gonorrhea, who has also been exposed to syphilis, should be treated with 4.8 million units of aqueous procaine penicillin G and should have monthly serologies for 4 months.

053. Specify the causative organism, transmission, incubation period, stages, and complications of syphilis.

Syphilis. Syphilis is one of the most commonly "heard of" sexually transmitted diseases of our times. Most people have "heard" that syphilis can get in your blood and attack your vital organs such as your heart or liver; that syphilis can make you deformed, insane, and even kill you. Although frightfully true, these statements are characteristics of late complications of syphilis which often occurred in the days before penicillin treatment. Today, the disease is easily treated and late complications are rare.

Transmission. Syphilis is caused by an organism called the *Treponema pallidum.* This thin, cork screw-like organism, gracefully invades the body by steadily rotating, like the propeller of a boat. Moisture and warmth of the human body are necessary for the organism to survive. Once outside the body, it dies quickly and is easily killed by soap and water if present on the skin. Close intimate contact with an infected person is necessary to become infected. During vaginal, anal, or oral-genital sexual intercourse the *T. pallidum* travels from the infected body and enters the uninfected partner through the breaks in the skin or mucus membranes. Once in the body, *T. pallidum* reaches the bloodstream within a matter of hours and is carried to all parts of the body.

Incubation period. During the first 10 to 90 days after sexual intercourse with an infected person, the disease develops in the body and there are no signs or symptoms of its presence. A blood test for syphilis usually will not detect the existence of the disease during this phase. This is a major factor in the syphilis epidemic; incubating syphilis cannot be detected until it reaches the infectious stage. Even if a person is made aware of exposure, he or she may feel that they are not infected because the blood test will have negative results and no symptoms will be noted. Some of these sexual contacts will develop the disease and unknowingly give it to others at a later date. The solution to this problem is the routine treatment of all persons exposed to early syphilis to prevent the disease from developing, thus insuring that they will not transmit the disease to others. This preventive treatment is the key to breaking the chain of infection responsible for the syphilis epidemic.

Primary syphilis. The first sign of syphilis, although it does not always occur, is a lesion (chancre) at the site where the *T pallidum* entered the body. Average time for the development of this small, painless sore is 21 days, but it may appear anywhere from 10 to 90 days after the incubation period. Chancres are usually single, but there may be more if different sites on the body were infected at the same time. Even though the chancre is the first visible sign, the disease has long since invaded the entire body.

In men, the chancre can appear anywhere on the penis, in the meatus, or on the scrotum, and is usually obvious. In women, the sore can appear at any site of the genital area, but because of the design of teh female reproductive system may go unnoticed. The chancre may appear in or around the anus of persons infected during anal intercourse or on the lips or inside the mouth. Chancres can be on other parts of the body that have minor injuries, like a bite or scratch. Chancres heal within 1 to 4 weeks if left untreated.

Secondary syphilis. About 6 weeks (average) after the first chancre surfaces, the untreated individual may enter the secondary stage of syphilis. At this time, a skin rash may appear on the chest, back, arms, legs, face, palms, soles, or scalp. If the rash appears on the vaginal lips, anus, and between the buttocks, it may form "condylomata lata." This type of rash is very moist and has an oozing fluid that is highly contagious. The rash takes the form of "mucous patches" when in the mouth or throat, affecting the mucous membranes in these areas. When in the throat, they can cause a mild sore throat and minor hoarseness.

The syphilitic rash does not hurt or itch. However, some people do develop frequent headaches, nausea, constipation, loss of appetite, fever, and muscle and joint aches. If not treated, the rash (and other symptoms) will go away in 2 to 6 weeks, but the disease is still in the body and heading for the most dangerous stage.

Latent syphilis. After the syphilitic rash heals, the untreated diseased person may not show any signs of the disease for years, which is the latent stage of syphilis. Within a 2 year period,some people again experience the signs of primary or secondary syphilis, appearing on the same site as before. This is called a relapse syphilis infection. After a few weeks, the chancre or rash disappears and once again the person is without symptoms. During the latent stage, the disease normally is not transferred to another person. An exception to this is the diseased mother, who can give it to the unborn child.

Congenital syphilis. In congenital syphilis, the *T. pallidum* is passed on to the unborn child from the mother's blood after the fourth month of pregnancy. This type of syphilis is acquired, NOT inherited, and possible even though the mother exhibits no external signs or symptoms. If the infection is in the primary or secondary stage the child may die before or shortly after birth. Children born to women in the latent stage may not be affected at all, but if infected, develop typical syphilis that is easy to treat Early diagnosis and treatment can prevent infection or damage to the fetus. Early prenatal care (including blood test for syphilis) is very important for the pregnant woman.

Most untreated cases remain latent, with no further ill effects for the rest of the person's life; but a few do proceed with further complications or late (tertiary) syphilis. This extremely rare today; however, this complication can cause major damage to the nervous system (neurosyphilis), the heart and other vital organs, and can be fatal. If syphilis is discovered during the primary, secondary or latent stages, treatment is relatively easy and effective.

Exercise (053):

1. Match the condition in column B with the description in column A. Conditions in column B are to be used once.

Column A	*Column B*
___ (1) Organism that causes syphilis.	a. Mucous patches.
___ (2) Classic sign of primary syphilis.	b. *T. pallidum.*
___ (3) Syphilitic rash of vaginal lips.	c. Latent syphilis.
___ (4) Produces highly contagious oozing fluid.	d. Chancre.
___ (5) A relapse syphilis infection may appear.	e. Condylomata lata.

054. List diagnostic procedures for syphilis.

Diagnosis. The major factor in the diagnosis of syphilis is the results of laboratory tests. However, medical examination, medical history, and the presence of syphilis in the person's recent sexual partner(s) are factors that are of great importance for confirmation.

There are two types of laboratory tests commonly used. The first is the microscopic examination of body fluid. Fluid obtained from an open sore is tested using a technique known as a dark field examination which can identify the disease at its earliest stage. Spinal fluid is examined in latent syphilis cases to make sure that the disease is not quietly developing in the central nervous system. A sample of the fluid that surrounds the spinal cord is extracted for testing by a procedure called a lumbar puncture. The second type of laboratory test is the serologic test which is the evaluation of blood extracted from the person's veins.

Darkfield examination. Demonstration of the causative organism is the best proof of any communicable disease. *T. pallidum* can be detected under a special microscope in the serum or tissue fluid from the lesions of early (primary and secondary) syphilis. The shorter the duration of the lesion, the more readily can organisms be found. The darkfield examination is an excellent test for early syphilis, but it is not easy to perform. A negative darkfield (inability to demonstrate *T. pallidum*) examination does not exclude the diagnosis of syphilis. If possible, at least three preparations should be done on the suspected individual. If the organism is not found initially, the individual should be urged to exercise preventive measures until the additional examinations are done. Serologic follow-up of all negative darkfields should be continued for at least 3 months. A positive darkfield examination is the demonstration of the spiral organism, *T. pallidum.* This consitutes evidence of primary, secondary, early congenital, or infectious relapse syphilis.

Serologic tests. Serologic (blood) tests for syphilis are used in two ways: as part of diagnosis in individual cases and for routine screening. The most commonly used serologic tests for syphilis are: Venereal Disease Research Laboratory (VDRL) test and the rapid plasma reagin (RPR) test which are used for routine screening and suspected cases, and the flourescent treponemal antibody absorption (FTA-ABS) test which is a more specific test used in problem cases or suspected false-negative or false-positive VDRLs.

Treatment. Syphilis can be cured by a variety of antibiotics. Unless an individual is allergic to it, penicillin is the treatment of choice for all stages of syphilis. (Refer to current CDC guidelines for appropriate treatment recommendations.)

All patients with early syphilis and congenital syphilis should return for repeat serologic tests at least 3, 6, and 12 months after treatment. Patients with syphilis of more than 1 year's duration should also have a repeat serologic test 24 months after treatment. Careful follow-up serologic testing is particularly important in patients treated with antibiotices other than penicillin. Examination of the spinal fluid should be planned as part of the last follow-up visit after treatment with antibiotics other than penicillin.

All patients with neurosyphilis must be carefully followed with periodic serologic testing, clinical evaluation at 6-month intervals, and repeat spinal fluid examinations for at least 3 years.

The possibility of reinfection should always be considered when patient with early syphilis need to be treated a second time. A spinal fluid examination should be performed before retreatment unless reinfection and a diagnosis of early syphilis can be established. Retreatment should be considered when:

a. Clinical signs or symptoms of syphilis persist or recur.

b. There is a 4-fold increase in results of a serologic test.

c. A serologic test showing a high result initially fails to show 4-fold decrease within a year.

Patients should be retreated according to the schedules recommended for syphilis of more than 1 year's duration. In general, a patient should be retreated only once.

Exercises (054):

1. What is an examination that is used to detect *T. pallidum* in serum or tissue fluid?

2. Name a serologic test that is used for routine screening and suspected cases of syphilis.

3. What is the procedure for collecting spinal fluid called?

4. A darkfield exam is good for detecting which stage of syphilis?

5. Name the most specific serologic test for syphilis.

6. Which tests are used for diagnosis and routine screening of syphilis?

055. Cite the causative organisms, symptoms, and possible complications of herpes simplex II and chlamydia infections.

Genital Herpes. Genital herpes has recently been labled as the "new VD," the untreatable, horrifying venereal monster of the '80's, the inevitable consequence for the sexually liberated generation. Needless to say, this is an exaggerated view of this sexually transmitted disease. The fact is that genital herpes has been recognized for many years. It is caused by a virus called herpes simplex virus (HSV). There are two types of HSV, type one (HSV1) causing cold sores or fever blisters of the mouth and type two (SHV2) causing genital herpes.

HSV2 is a virus that invades the nerve cells of the infected area that are responsible for sensation (i.e., touch or temperature). After the initial infection, the HSV2 leaves the infected genital area and travels to the nerve cells that lie next to the lower part of the spinal cord. The virus lives here for the rest of the person's life. However, periodically thereafter, reactivation of the virus within these nerve cells causes the virus to retrace its path back to the nerves of the initially infected site. It is possible for this "relapse" to occur years after the initial infection and to be frequent or few. Due to antibodies produced by the body to fight off the first invasion of the virus, repeat episodes are generally not as painful and do not last as long as the initial infection.

The initial infection is contracted by close physical (intimate) contact with a person actively infected. The infection usually begins as small painful blisters which contain clear fluid. In a few days, the blisters break open to form shallow, painful sores which, over a period of several weeks, form scabs and then heal. The lymph nodes (glands) in the groin may swell and become very tender. The infection may occur in any area, but it usually occurs on or near the sex organs. Females may experience considerable pain when large areas of the vagina are involved, but can also have the sores on the cervix, which are painless but do cause a noticeable discharge. The incubation period for herpes is 2 to 20 days, with an average of 6 days. The herpes sore sheds the live virus. A person can infect themselves at another site by touch, so hygiene is important. The sores are most infectious to others during the blister and open sore stages, but some virus probably remains until the sore has completely healed. The herpes virus is likely to become reactivated when the body is weakened, so the best defense against these recurrences is to maintain the body in a state of good health by sufficient food, rest, and exercise.

Genital herpes may be transmitted to the infant as it passes through the infected birth canal during delivery. Therefore, women with herpes should be examined frequently during pregnancy, and if there's a sign of an active infection, a cesarean section may be advisable since the virus is often fatal in the newborn.

At this date, there is no effective and safe treatment for genital herpes infections, and nothing will get the virus out of all the cells. Fortunately, the body's resistance mechanisms will control the infections. When pain is severe, bathing the sore area with warm water and using mild pain relievers often helps.

Chlamydia Infections. Chlalmydia infections are caused by *Chlamydia trachomatic* which has characteristics of both viruses and bacteria. There are many strains of *Chlamydia trachomatis*, but only a few cause infection of the urethra and cervix. This organism is also the cause of another sexually transmitted disease called lymphogranuloma venereum and other types of diseases, such as the eye disease, trachoma.

The chlamydia infection is very similar to gonorrhea. Early infection causes no symptoms in women. In men the common discharge and discomfort of urethral infections are less dramatic than that due to gonorrhea. The chlamydia organism does not survive in the ambient environment, so intimate contact is necessary for transmission. In men, untreated infections can eventually cause infections of the prostate and epididymis. Pelvic inflammatory disease develops in women when the infection goes untreated for an extended period of time. PID caused by chlamydia can be more serious than that caused by gonorrhea, even though the symptoms are milder (less pain, etc.). Damage to the reproductive organs may be more severe, increasing the risk of infertility and ectopic pregnancy.

Chlamydia may be transmitted to the newborn during birth if the mother is infected. The most serious effect, pneumonia, develops slowly, appearing in the second month of life. This condition is easily treated, but could persist for months if the mild symptoms (slight cough and lack of weight gain) go unnoticed. Chlamydia sometimes causes "postpartum fever," a potentially serious infection in the mother after delivery.

Chlamydia infections should be treated in accordance with current CDC guidelines. Test of cure (TOC) cultures should be performed 3 to 6 weeks after treatment; if positive, the person should be retreated.

Exercise (055):

Place a T in front of the correct statements. Explain why the others are false.

____ 1. The herpes simplex virus 2 (HSV2) invades the nerve cells that lie next to the spinal cord, causing a deterioration of the cells that can eventually lead to insanity.

____ 2. A person with open herpes sores can spread the infection to other parts of the body by touch.

____ 3. Genital herpes can be inherited by an unborn child if the mother becomes infectious close to delivery.

____ 4. Chlamydia infections are caused by an organism that can also cause disease other than those that are sexually transmitted.

____ 5. A chlamydia infection closely resemble gonorrhea and if left untreated causes no distinct symptoms in the infected individual.

____ 6. Pregnant women with chlamydia should be treated and receive test of cure cultures within 7 to 14 days of initial treatment.

056. Describe the cause, symptoms, and possible complications of vaginitis and lymphogranuloma venereum.

Vaginitis. The inflammation of the vagina is the most common disease associated with the female sexual organs. This common cause of discomfort in women is not dangerous but it does deserve immediate medical attention. Vaginitis (caused by germs) is often associated with sexual activity and can easily be diagnosed by examining vaginal secretions under a microscope. The two most common forms of vaginitis are trichomoniasis vaginitis and yeast infections.

Trichomoniasis. Trichomoniasis is the form of vaginitis caused by a small protoza called *Trichomonas vaginalis.* At room temperature, this organism can survive on moist objects for several hours. Consequently, a woman can become infected if her vagina comes in close contact with a bath tub, sauna seat, hot tub, towel, washcloth, etc., that has been used by an infected woman. Sexual contact is the more common mode of transmission. Men can maintain the germ underneath the foreskin of the penis or in the prostate glands without ever experiencing symptoms of its presence. Therefore, during intercourse, the organism may be rubbed off the man's penis onto the sides of the woman's vagina. Symptoms of trichomoniasis include a heavy, foul discharge that can be white, yellowish or greenish, and often frothy. Irritation of the vagina and vulva causing soreness may be symptoms, too. Itching also occurs with frequent burning during urination as the urine contacts the infected area. Females who have trichomoniasis demonstrated by examination of vaginal secretions should be treated, as should her sexual partner(s).

Vaginal yeast infection. Yeast infection, also known as monilia infection, is caused by a fungus called *Candida albicans.* This organism is frequently present in the rectum and vagina of healthy women and causes harm only when there are too many of them. Many factors that alter the acid-base relationships in the vagina can allow these organisms to increase in number: antibiotics, douching, pregnancy, and diabetes, to name a few. The infectious organisms can reach the vagina in many ways, one of which is spread from the woman's own anus along the surface of a menstrual pad or when the woman wipes herself after a bowel movement. The fungus can also be transmitted during sexual intercourse. The organism can survive under the foreskin of an uncircumcised man or can develop infection in the throat of an individual (called "thrush") after oral-genital contact with an infected person. In women, the symptoms include mild to intolerable itching of the vulva, with redness and swelling of the labia minora. There's usually a white, thick, cottage cheese-like discharge. An itchy red rash on the penis and under the foreskin may occur in infected men. Infected women and their sexual partner(s) should be treated.

Lymphogranuloma venereum. Lymphogranuloma venereum (LGV) is a large-virus, sexually transmitted disease of the lymphatic system. The lymphatic system is made up of lymph fluid, which is similar to blood; lymph vessels, that run parallel to the blood vessels and empty into large veins in the upper chest; and lymph nodes that are concentrations of tissue found in various parts of the body including the armpits, neck, and groin. LGV may be caused by several related chlamydial organisms (see previous discussion on chlamydia) that invade the skin of the sexual organs during sexual contact with an infected person. Five to 21 days (usually 7 to 12 days) after infection a small, painless, pimple-like sore appears on the sexual organs, but generally disappears by itself within a few days. Since the sore is painless, it often goes unnoticed by the infected person if hidden under the foreskin of the penis or inside the vagina. If untreated, 10 to 30 days after initial infection, the virus travels to the lymph nodes of the groin area and form a bubo. An individual may then experience fever, chills, abdominal pains, loss of appetite, and joint pains. The bubo is very obvious and painful, making most people seek immediate medical attention. However, in those who don't or if the bubo does not form, the disease can cause serious complications.

Complications may develop anywhere from 1 to 10 years following initial infection. The walls of the rectum may become narrowed forming a rectal stricture that causes difficult and painful bowel movements accompanied with episodes of serious constipation. LGV elephantiasis is another complication in which the infected lymph vessels in the genital area blocks normal flow of lymph fluid causing a great swelling of the sexual organs. LGV is difficult to treat. An individual should receive follow-up examinations and tests every few months for 1 year and then yearly, after treatment.

Exercise (056):

1. What is "thrush"?

2. What are some complications of LGV?

3. What are some of the factors that allow the fungus *Candida albicans* to multiply in the rectum and vagina of women, thus causing a yeast infection?

057. Identify the causes, symptoms, and modes of transmission of nongonococcal urethritis, hepatitis, pediculosis, and AIDS.

Nongonococcal urethritis. Nongonococcal urethritis (NGU) is the inflammation of the male urethra that is not caused by a gonorrhea infection. There is no specific causative organism for this condition, so it is also called nonspecific urethritis (NSU). By whatever name this condition is diagnosed as, there's one thing that's certain; this condition is transmitted through intimate contact. There are several possible causes of NGU; the chlamydia trachomatis bacteria, which may also be responsible for other sexually transmitted infections, and the T-strain mycoplasma (also called ureaplasma) bacteria are the most common. Men whose urethras are still weakened from a gonorrheal infection are at a very high risk of developing NGU. Although women do not develop the disease, some are carriers, and can infect the male sexual partner(s) during vaginal, anal or oral-genital intercourse. Symptoms are similar to gonococcal infections—a discharge of pus from the urethra and mild to moderate pain or burning at the top of the penis during urination. If untreated, the symptoms will disappear within 2 or 3 months, but the organisms remain and can spread to the prostate or the epididymis. An unusual form of arthritis known as Rester's syndrome is another complication in the untreated male. This condition causes inflammation of the joints, skin, eyes, and urethra, but is not normally permanent or crippling. Careful examination (symptoms are not as severe as gonorrhea), history of sexual activity, and a negative gram stain smear to rule out gonorrhea are all necessary for diagnosis. The treatment for NGU is antibiotics taken orally for 1 week. (See current CDC guidelines.)

Heptaitis. Hepatitis A, hepatitis B and hepatitis non A non B, can transmitted during intimate (sexual) contact. Hepatitis B virus infections are more commonly seen in homosexual males (transmitted through infected semen ejaculated in the anal canal). Studies show that in men with over 10 years of homosexual activity, two-thirds or more have had hepatitis B infection. There is less evidence that heterosexual men acquire this infection sexually. The symptoms, diagnosis, and treatment of hepatitis were explained earlier in this volume.

Pediculosis. Certain characteristics of *Phthirus pubis* (crabs or pubic lice) makes transmission of the clawed creatures more probably during sexual activity than during any other activity. Adult pubic lice mate quite frequently during their short lifetime, and to do so, the male and female have to grasp adjacent body hairs that are about 2 millimeters apart. The distance between the louse's rear legs is about the same, and is the extent of their reaching ability. Lice do not jump, they move by swinging from hair to hair, and seldom live longer than a day away from the body. So, most commonly a person becomes infested through very close contact (within two millimeters) with an infested person's public hair. The symptoms, diagnosis, and prevention of pediculosis are explained later in this volume.

Aquired Immune Deficiency Syndrome (AIDS).

AIDS is a serious condition characterized by a specific defect in the natural immunity against disease. People who suffer from AIDS have a variety of rare illnesses. These illnesses are not normally found, or are mild, if they occur, in people whose immune systems are normal. The two diseases most commonly found in AIDS patients are *Pneumocystic carinii* pneumonia, a lung infection caused by a parasite, and Kaposi's sarcoma, a rare form of cancer or tumor of the blood vessel walls.

Many AIDS patients do recall having some symptoms before being diagnosed. Some of these early signs are like those of many other illnesses such as cold or flu. These symptoms may include fever, night sweats, swollen glands (enlarged lymph nodes)—in neck, armpits, or groin,—unexplained weight loss, diarrhea, persistent coughs, fatigue, and loss of appetite. The incubation period for AIDS appears to range from a few months to about 2 years.

Nearly 95 percent of the AIDS cases have occurred in people belonging to one of four distinct groups: sexually active homosexual and bisexual men with multiple sex partners (75 percent of all or the reported cases); present or past abusers of intravenous drugs, 17 percent; persons with hemophilia, 8 percent; Haitan entrants into the United States, 5 percent.

Scientists have not discovered the cause of AIDS, but they suspect that it is caused by a virus, possibly one present in the blood and/or body fluids, such as semen. AIDS appears to be primarily transmitted through sexual contact. Some of the women who have developed AIDS have been steady sex partners of men with AIDS or men who are at high risk for AIDS, or they have a history of drug abuse. No cases have been found to date where AIDS has been transmitted by casual or even close daily contact with AIDS patients or persons in the high risk groups.

AIDS is a most serious disease with about a 40 percent death rate. There is no known cure, so treatment is primarily aimed at keeping it under control. If it is obvious that the infected person is dying, treatment is to provide the most comfortable and respectful death possible.

Exercises (057):

1. Name a possible causative organism for NGU.

2. What STD is mostly transmitted through infected semen ejaculated in the anal canal?

3. Name a highly fatal STD.

4. Where do symptoms usually occur for NGU?

5. Are women or males usually carriers of organisms causing NGU?

6. Cite another slang name for a pubic louse.

7. Which STD does not commonly occur in women?

058. Cite the risks involved in STD transmission and ways to prevent these risks.

STD Prevention. Success in the prevention of sexually transmitted diseases requires coordinated and continuous effort applied in an intelligent, unbiased, and understanding manner by all personnel involved. Thorough knowledge of the disease through education, appropriate application of prophylactic (preventive) measures, early detection and treatment of infected personnel, and the curtailment of the sources of infection and contact interviewing are all major factors in controlling epidemic measures of these diseases.

Prevention of sexually transmitted diseases is basically a matter of decreasing the risks. Persons who have a lot of direct contact with the skin, mucous membranes, or body secretions of others are at a high risk of getting a sexually transmitted disease, since this is how the disease is transmitted. Persons who have a lot of sex partners are at a higher risk than those who have only 1 sex partner. If a person's sexual partner has many other partners or lives in an area where sexually transmitted diseases are common, the risk is again high. Persons who know their sex partner(s) will have less STDs . . . at least they will know how to get back in touch with them. Varying sex acts may have different degrees of risk. For example, mutual masturbation, watching erotic films, etc., present a low degree of risks, but sexual penetration and oral contact present a high degree of risk. The availability of diagnosis, treatment, and education reduce the risks. However, disease characteristics are a major factor—if a disease has a long incubation period or few to no symptoms, a person is likely to become infected unknowingly. Now that we understand the risks involved in catching an STD let us look at ways of preventing it.

Because persons who are likely to transmit STD generally do so unknowingly, the recent sexual partner(s) of persons with a STD must be tested and treated as soon as possible. Sex partner(s) generally come from the person's social group, so the prime target for prevention of future infections would be to have all sexual contacts treated. Individuals should be encouraged to practice personal preventive measures such as the following: Decrease the number of different sexual partners (this does not necessarily mean a decrease in the person's sex life) Keep the name and number of sexual partners (a little black book); even if they are just casual contacts they can be contacted and given treatment. Restrict certain activities, such as oral-anal sex, anal and vaginal penetration, to a few well known partners (who restrict themselves in similar ways). Visually check a partner's genital organs; if a discharge, sore, or rash is noted, delay sexual intercourse until another time (preferably after the person has visited the medical clinic). Individuals should understand that adjusting one's lifestyle and postponement of spontaneous sexual activity are preventive measures that require strong self-motivation, but are proven to be very effective.

Women and men can examine themselves for signs of disease, such as bumps, sores, and discharge. Basic hygiene such as washing with soap and water is a good practice; whether or not it actually prevents disease is not clear. Vaginal contraceptives are known to kill bacteria as well as sperm, and condoms (a thin sheath worn over the penis during sexual intercourse) protect the parts of the body they separate. Condoms are readily available at all military installations, and their use is highly recommended. Finally, people who are at an increased risk of developing a STD should be encouraged to be routinely (maybe four times a year) tested for infection. This can help detect asymptomatic infections, thus reducing the chance for complications and disease transmission.

Germs have no sympathy, empathy, or simply any type of feelings for the people they infect. They don't care if people are married, in love, or barely know each other, if partners are of the same or opposite sex, if there are lasting feelings, or just a casual fling. Germs are only interested in having a moist, warm place to grow and reproduce. Prevention of STDs requires motivation and a little common sense. The main goal is to promote one's interest in his or her own health and that of one's partner(s).

Exercises (058):

1. What must be done to the recent sex partner(s) of STD cases in order to stop the infectious chain?

2. Routinely, what should persons at an increased risk or contracting venereal infections receive?

3. Where do a person's sexual partners mostly come from?

4. When a disease has a long incubation period or few symptoms, what may a person not be aware of?

5. What should persons at a high risk keep so that sexual contacts can be easily identified to the authorities?

6-2. STD Interviews

STD epidemiology is simple in theory but complex in application. Let's look at the recognized techniques and procedures which have been used and proven to be effective with regard to interviewing and counseling. However, it must be pointed out and understood that the extremely complex nature involved in the application of basic principles to individual cases, *each of which is unique because of the human element,* will necessarily require your resourcefulness, imagination, flexibility, and determination.

059. Cite the elements of an effective and successful STD interview session.

Purpose. Intensive case counseling/interviewing and documenting for evaluative purposes are applied to every diagnosed case of STD. The ultimate goal is to bring to treatment, *with the greatest possible speed to avoid continued spread of the disease,* every existing case of STD connected directly or indirectly to the originally diagnosed patient. The counsel/interview represents a confidential relationship between the patient and the interviewer. The effective interview depends upon the capability of the interviewer, the setting of the interview, and the techniques used in the interview.

The Interviewer. You, as an interviewer, should be well educated. However, this is not as essential as good common sense and the ability to deal with people. Skill, patience, tact, and diplomacy are a few of the assets exhibited by the effective contact interviewer. If you expect to gain confidence and cooperation, you must convince the patient of your genuine desire to help. You must like people and they must like you. You must show mature understanding, a sympathetic viewpoint, and a nonjudgemental personal attitude toward sex and the venereal disease. You must have an appreciation of life in the modern world and a thorough working knowledge of the variability of sex habits in different people. You should have a knowledge of the local area to help refresh the memory of the patient regarding places where he or she could have met or taken his or her contacts.

The Interview Setting. A favorable atmosphere for the interview is vital in its effect upon the patient. The first and most important physical provision is privacy. The interviewer and patient should be free from interruptions. Nothing can do more to spoil an interview than an unexpected or unannounced entrance of some other person. A knock on the door or even a ringing phone can have about the same effect. The interview room should contain only the forms and aids used in the interviews. There should be STD literature available, which should be given to the patient at the close of the interview.

Interviewing and Counseling Techniques. You should hold the counsel and interview as soon as possible after the diagnostic examination with the doctor and prior to treatment. Certain principles and practices determine the success or failure of the session. Employ tact and establish rapport. You should be especially careful to employ the techniques described in the following paragraph.

Precounsel/interview analysis. The greater the amount of patient information known prior to the session, the better you will be able to deal with problem(s) presented by the patient. Gain an understanding of why the person had the exam (symptomatic, contact, suspect, routine screening). Check the medical record for medication allergies and the patient's STS/culture history—verify past blood or culture test results and reason for test or note a history of negative tests. Also, note the likely critical period, which would be based on the patient's duration of symptoms and the maximum incubation period for the infection diagnosed.

Assessment of the problem. Verify the assumptions you made in the precounsel/interview analysis.

a. Determine the patient's understanding, attitudes, and concerns about his or her infection.

b. Relax the patient.

c. Ask about pertinent medical history that may not be included in the patient's medical record.

d. Gather fundamental information for *required* epidemiologic analysis—i.e., living with situation, occupation/squadron, recent travel, etc.

e. Project an image of competence and understanding.

f. Tell the patient exactly what you will be doing and want to discuss.

Reinforce compliance. Give information that will be of benefit to the patient, making the patient aware of the importance of immediate treatment of one's self and sex partner(s).

a. Review important facts about the patient's disease. As a minimum you should discuss the mode of transmission, symptoms (or lack of symptoms), and severe complications of the disease. If the patient responded to disease symptoms or a suspicion of disease, "stroke" the patient—they did the right thing by coming to the clinic and should do the same if it should happen again.

b. Review the patient's need for follow-up tests. Always consider the patient's duty hours, such as for those working midnight and swing shifts, special arrangements may have to be made to assure the patient's return.

c. Review the patient's treatment regimen: What the medication is and the possible side effects. Persons taking oral medication should be counseled on the importance of taking all of the medication as prescribed. You should identify and discuss potential compliance problems by working with the patient to establish a specific schedule for taking the medication. For example, if the patient must take the medication four times a day for 1 week, work out a plan for taking the medication upon rising in the morning, at lunch time, at the end of the work day, and just before retiring. People who work midnight and swing shift may better comply with the treatment regimen by taking it during the hours just before the duty shift through retiring. Regardless, of whether the medication is administered at one time or throughout a specified time, the patient should be made aware of the rules to follow prior to being tested for treatment success. In addition to those specific for the antibiotic used for treatment, the one rule that you should emphasize is to abstain from any sexual contact that would increase the chance of reinfection.

Elicit all critical period sex partners. Explain to the patient the critical period and the importance of obtaining contact information. (This is recorded on CDC 9.2936.) The patient should be reminded that he or she is the only one who knows who his or her contacts were and that the health and perhaps the lives of these persons depend upon his or her willingness to help them. Assure the patient that any information that is revealed will be kept confidential; that the persons whose names he or she furnishes will never know who revealed them. It is imperative that the patient realize that he or she is not a "squealer" but is helping to protect friends and contacts from the hardship and discomfort of the disease. Impress upon the patient that there is no punishment associated with locating the contact. The only action taken is treatment of the disease. Having set the stage, proceed with the interview. Discuss with the patient one contact at a time, beginning with the most recent and working back. Start with the place of encounter. This is probably more easily recalled by the patient than the color of the contact's hair or eyes.

Counseling/interviewing. Counsel each patient regarding risk reduction or risk avoidance. Identify what the high-risk situation would be for the patient. Review prevention options and discuss how these options might be adapted to fit the patient's lifestyle. You should secure a verbal committment from the patient to adopt some prevention plan. You should always close the session with a restatement for return appointment and offer the patient educational materials on the disease and its possible complications.

The following points are suggested for you to keep firmly in mind to help increase your chance for a successful counsel/interview session:

a. State questions in a positive manner. A negatively posed question is sure to get a negative response.

b. Don't be reluctant to talk about sex or various types of sexual behavior. Keep an open mind.

c. Be professional. Don't show surprise or disgust at a patient's response.

d. Stay in control of the conversation. Don't agree with the patient or confirm a negative response.

e. Be a good listener, but don't let the session drag or become onesided.

You should strive to increase the patient's self respect. Praise him for his cooperation. Always use persuasion rather than attempt compulsion to gain cooperation. This means being patient. Don't use third degree methods. Lastly, remember that the patient is an individual with feelings and differences. No two patient react exactly alike.

Exercise (059):

1. When should the interview be accomplished?

2. What is the duration of symptoms and the maximum incubation period for the disease called?

3. An STD interviewer should always project what type of an image?

4. What should your minimum education of the patient include?

5. Cite two types of responses to a patient's comments that you as an interviewer should avoid.

6-3. The Air Force STD Control Program.

An effective venereal disease program depends upon (1) an understanding of the Air Force policy on the occurrence of sexually transmitted diseases, (2) an aggressive health education program, (3) prompt diagnosis and medical treatment of cases, (4) effective case finding procedures, and (5) systematic follow-up of cases. STD incidence statistics kept up to date will serve the dual purpose of recording data for required reports and reflecting the effectiveness of your program.

060. Describe the factors included in the phases of an effective STD control program.

Air Force Policy. As stated in AF Regulation 161-7, *Control of Venereal Diseases*, the occurrence of a STD is never used as the basis for punitive action against an individual. Such measures only lead to concealment, inadequate treatment, and to continued transmission of these diseases,as well as serious complications. However, repeated occurrences of venereal disease in an individual may be considered as a sufficient basis for administrative or corrective action. In determining appropriate action in any individual case, a commander will consider the impact of his or her decision on the individual concerned and on the prevention, control, and treatment efforts of his or her command.

Air Force policy also states that the name of the patient will not be divulged except in compliance with a valid court order or incidental to the release of medical records (as in the case of a records review). However, there is no medical personnel/patient privilege of nondisclosure of confidential communications in military law. Thus, if the response to that person indicates that a sexual crime has been committed (rape, if the person names a contact of the same sex,or indecent acts with a child under 16 years of age) you not only can disclose such information, but are required to report it to the Air Force Office of Special Investigation (OSI). Note that this disclosure is not based on the fact that the individual has a sexually transmitted disease, but that a sexual crime has been committed.

Health Education. This should be a continuing program directed to the general base population. Subjects should be presented in simple, factual, and interesting terms. Many opportunities for the application of this type of program will present themselves to you. Commander's call, personal hygiene lectures, and similar speaking engagements are ideal for more personal facets of the program. Pamphlets and public news media can be used for the more nonpersonal topics. Topics should be carefully chosen to fit the community and audience but should cover the following terms:

a. Cause and early symptoms of the various types of STDs.

b. Means of spread and prevention.

c. Necessity for prompt reporting by the patient if infection develops or is suspected.

d. Need for follow-up by the patient and medical authorities to insure that treatment was effective.

e. Necessity for remembering or keeping names, addresses, etc., of sexual contacts, to help locate infected contacts.

Diagnosis and Medical Treatment. This requires the cooperation of a specialized set of medical services, working together in constant communication if the spread of disease is to be contained. The physicians or medical practitioners perform diagnostic evaluations and prescribe and administer treatment. The medical laboratory analyzes smears and/or darkfield specimens and identify organisms from material submitted for cultures or serologic tests. Patient Affairs reports statistical data on STD cases (provided by Environmental Health Services) to the Air Force and civilian agencies. Environmental Health SErvices, on the other hand, is responsible for the overall management of the STD program. You are responsible for education (individual base-wide and sometimes local), epidemiological procedures, ensuring cases participate in and receive adequate follow-up, and coordination with the state or local public health agencies.

Case Finding Procedures. This is fundamental to STD control. All health care providers should constantly be alert to the possibility of infection in the person examined. Screening examinations, such as premarital, prenatal, aviation cadet, and annual physicals are also ways of discovering early infections. However, the most direct approach is contact investigations. This involves reporting without delay to the proper authorities the names, descriptions, and identifying data of all individuals to whom the patient may have transmitted or from whom he or she may have acquired this infection. All contacts are examined and, if appropriate, immediately treated for the suspect infection. If results of the tests are positive (confirm presence) the contact is then considered a patient and must be interviewed.

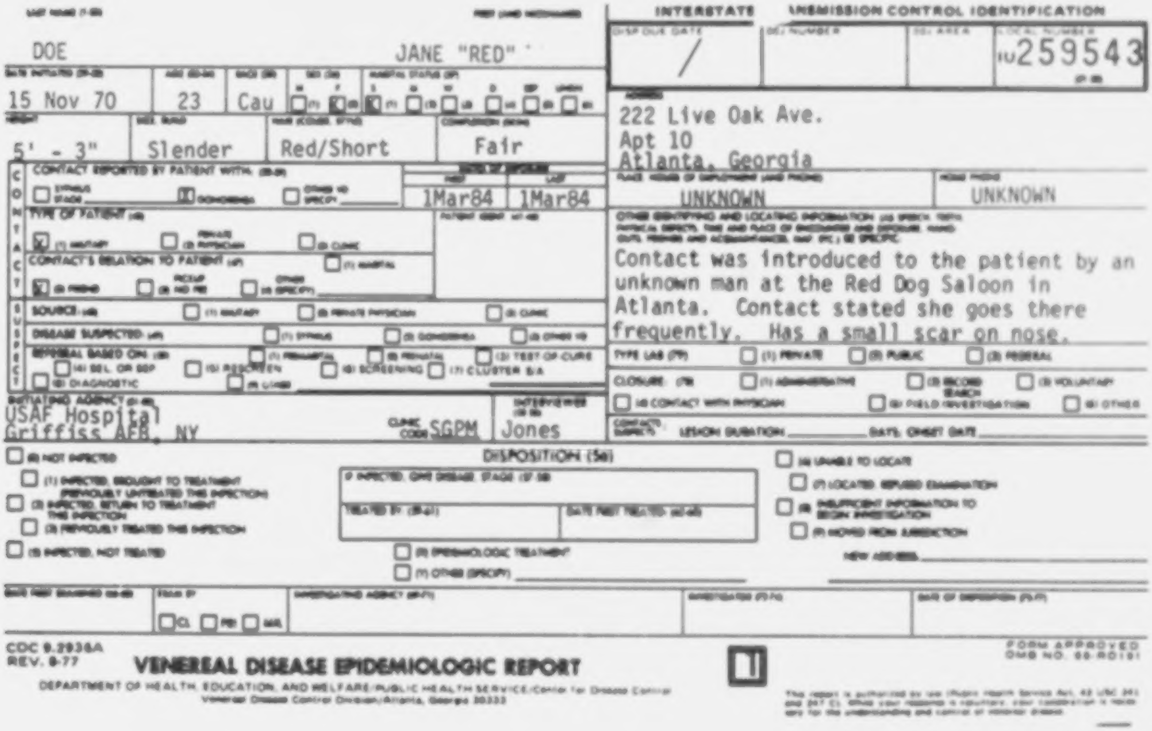
Preparing Contact Reports. Information that identifies civilian contacts residing in the United States, its territories, or possessions will be reported on CDC 9.2936 or CDC 9.2936A, Venereal Disease Epidemiologic Report, as appropriate. A separate report, in quadruplicate, will be prepared for each named contact. The fourth copy of the form may contain the patient's name, grade, social security account number (SSAN), and military address. This can be printed or typed on the back of the form and maintained in Environmental Health Services. The first three copies are routed according to the local public health facility as determined by contact location. Speed is essential in tracing contacts. Thus, this form should not be considered a "routine" report. Each report deserves special handling and individual considerations in routing. Figure 6-4 shows a completed CDC 9.2936A. Only the appropriate section CONTACT (actual sexual encounter with the patient) or SUSPECT (no sexual contact with patient but whom patient suspects may have the disease) should be completed, never both. Detailed directions for completing, routing, and disposition of this form appear in AFP 160-5-8, *Interviewer's Aid for VD Contact Investigation.*

Follow-up. Proper epidemiology requires periodic laboratory follow-up examinations on STD cases. For this purpose and as an aid in maintaining a well-rounded, up to date STD control program, a suspense file should be maintained. Include in this due dates for all tests of cure cultures, or examination serologic tests and locating information on all STD patients and contacts. Routine follow-up is the important final step in a well conducted epidemiology program.

Exercises (060):

Mark each statement True (T) or False (F). Correct any False statements.

____ 1. Medical personnel should never disclose confidential communications concerning a STD patient.



DOE JANE "RED"

15 Nov 70 | 23 | Cau | ☐ M ☒ F | ☒ S ☐ ☐ ☐ ☐ ☐

5' - 3" | Slender | Red/Short | Fair

INTERSTATE TRANSMISSION CONTROL IDENTIFICATION

DISP DUE DATE /

LOCAL NUMBER IU259543

222 Live Oak Ave.
Apt 10
Atlanta, Georgia

UNKNOWN | UNKNOWN

CONTACT

CONTACT REPORTED BY PATIENT WITH: ☐ SYPHILIS STAGE ☒ GONORRHEA ☐ OTHER VD SPECIFY

DATE OF EXPOSURE: FIRST 1Mar84 LAST 1Mar84

TYPE OF PATIENT: ☒ (1) MILITARY ☐ (2) PRIVATE PHYSICIAN ☐ (3) CLINIC

CONTACT'S RELATION TO PATIENT: ☐ (1) MARITAL ☒ (2) FRIEND ☐ (3) PICKUP NO RE ☐ (4) OTHER SPECIFY

SUSPECT

SOURCE: ☐ (1) MILITARY ☐ (2) PRIVATE PHYSICIAN ☐ (3) CLINIC

DISEASE SUSPECTED: ☐ (1) SYPHILIS ☐ (2) GONORRHEA ☐ (3) OTHER VD

REFERRAL BASED ON: ☐ (1) PREMARITAL ☐ (2) PRENATAL ☐ (3) TEST OF CURE ☐ (4) DEL. OR BBP ☐ (5) RESCREEN ☐ (6) SCREENING ☐ (7) CLUSTER S/A ☐ (8) DIAGNOSTIC ☐ (9) OTHER

Contact was introduced to the patient by an unknown man at the Red Dog Saloon in Atlanta. Contact stated she goes there frequently. Has a small scar on nose.

TYPE LAB: ☐ (1) PRIVATE ☐ (2) PUBLIC ☐ (3) FEDERAL

CLOSURE: ☐ (1) ADMINISTRATIVE ☐ (2) RECORD SEARCH ☐ (3) VOLUNTARY ☐ (4) CONTACT WITH PHYSICIAN ☐ (5) FIELD INVESTIGATION ☐ (6) OTHER

INITIATING AGENCY: USAF Hospital Griffiss AFB, NY | CLINIC CODE SGPM | INTERVIEWER Jones

DISPOSITION (56)

CDC 9.2936A
REV. 9-77

VENEREAL DISEASE EPIDEMIOLOGIC REPORT

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE/PUBLIC HEALTH SERVICE/Center for Disease Control
Venereal Disease Control Division/Atlanta, Georgia 30333

FORM APPROVED

Figure 6-4. CDC Form 9.2936A, Venereal Disease Epidemiologic Report.

___ 2. A newspaper article on the cause and early symptoms of various STDs is a form of health education.

___ 3. The most direct approach to case finding is contact investigation.

___ 4. CDC 9.3936 or CDC 9.2936A, Venereal Disease Epidemiologic Report, identifies only those civilian contacts residing in the United States.

___ 5. The hospital's patient affairs office provides environmental health service with statistical data on STD cases.

Medical Zoology

INSECTS ARE probably the most successful of all land animals. They are found in the air; on, in, and under soil; and in fresh and brackish water. They eat the leaves and roots of plants and bore into all types of vegetation. Some insects live on or inside other animals. Many compete fiercely with other species of parasites or act as predators in preserving the check and balance in nature. Despite their small size, the combined bulk of insects exceeds that of all other land animals. Over 1 million species of true insects have been described to date and the number may reach 10 million or more.

For centuries humans have fought insects as pests, as carriers of disease, and as destroyers of food. This combat will continue for a long time, for humans have not yet eradicated a single insect species from the earth. Today, many disease vectors and economically important species are resistant to insecticides. However, when the need to control insects is sufficiently urgent and humans have the will to do a good job, they can keep them under reasonable control.

7-1. Introduction to Medical Zoology

Insects and other arthropods are the vectors of more than 100 human diseases. One of these, malaria, is judged by the World Health Organization (WHO) to be "the most important disease in the world." The Environmental Health Service is tasked with developing ways to control or prevent diseases. We have to know a lot about insects if we hope to prevent the diseases they transmit.

Before we discuss how insects affect humans, let's review the functions and responsibilities of agencies involved in insect identification and control.

061. Identify the functions and responsibilities of pest management.

Functions and Responsibilities. Pest control is not accomplished by one agency with the Air Force. The base civil engineer, DBMS, and professional entomological support agencies all have an important role in controlling potential disease vectors at your base.

Base civil engineer. The base civil engineer (BCE) insures that personnel are properly trained and certified in pest control. The BCE plans, initiates, and supervises all base civil engineer pest control activities occurring on your base. This includes controlling pests (except domestic animals) of economic and medical importance and inspecting and determining effectiveness and safety of control measures used.

DBMS. The Director of Base Medical Services (DBMS) determines the source, identity, and prevalence of pests that affect the health and efficiency of personnel—i.e., *disease vector surveys.* This is the major area you will be involved in. How you do this disease vector survey will be explained in detail later in this chapter. We will describe for you how you can determine the source, prevalence, and identity of pests at your base. The DBMS recommends personal protective measures for the populace, such as the use of bed nets and repellants and provides instruction for their use. The DBMS recommends measures for controlling animal reservoirs and vectors of disease and evaluates the effectiveness of these control measures. The DBMS (or his or her representative), also provides technical guidance to assure that pesticides are used safely and with the appropriate concern for the environment.

Professional entomological support. Professional entomological support is provided by the Epidemiology Division, USAF School of Aerospace Medicine (USAFSAM/EKED) and the Occupational and Environmental Health Laboratory (OEHL) located at Brooks AFB TX; the OEHL at Clark AFB, Republic of the Philippines Islands; as well as your Command Entomologists. They develop base and command level pest control programs. These support personnel identify and pests found during the surveys as well as provide help for pest control problems your base may have. Additionally, you can consult them for the proper use of pesticides and pesticide resistance problems. OEHL will provide you with information concerning the health effects of occupational exposures to pesticides, both acute (short) and chronic (long term) exposures. OEHL also makes recommendations concerning the disposal of pesticides. Miscellaneous agencies (such as local and United State Department of Agriculture and the EPA) can give you advice on entomology matters, too.

Exercise (061):

1. Match the agency in column B with its function or responsibility in column A. Some items in column B may be used more than once.

Column A

___(1) Disease vector surveys.
___(2) Insures that personnel are properly trained and certified in pest control.
___(3) Recommends personal protective measures against disease vectors.
___(4) Develops base and command level pest control programs.
___(5) Makes recommendations on disposal of pesticides.

Column B

a. Base civil engineer.
b. DBMS.
c. OEHL, Brooks AFB TX.
D. Professional entomological support.

—— (6) Consultant on acute and chronic effects of pesticides.

062. State how insects are identified and the ways in which they develop.

Principles of Taxonomy. An elementary knowledge of insect structure is necessary for the correct identification (or taxonomy) of insects, the first step in any study on insect biology or control.

External structure. One of the chief differences between an insect and humans are in the skeleton. In insects, the "skin" has become hardened, almost like a suit of armor, into a stiff outer skeleton, or exoskeleton. This exoskeleton protects the internal organs from injury and serves as a framework for the attachment of muscles. By contrast, in humans and the vertebrate animals, the skeleton is inside the skin and is called an *endoskeleton.*

The body of an insect is divided into three main regions—the head, thorax, and abdomen (fig. 7-1). In the related class Arachnida, called arachnids, the body is composed of only one or two main regions. The arachnids include ticks, mites, scorpions, spiders, and harvestman.

In most insects, the outer parts of the body wall are hardened or sclerotized into plates, or sclerites, which are not flexible. These *sclerites* are joined by flexible portions of the body wall called *intersegmental membranes*, which allow considerable movement. For example, the abdomen of a mosquito becomes greatly distended during feeding. The sclerites may be covered with many small structures, such as hairs, scales, protuberances, and spines, many of which are useful in insect identification.

Physiology. Insect physiology deals with the functioning of the various organs and systems in supporting the life of the insect. There are many vectorborne diseases with complex cycles. Generally, the vector's digestive system is involved since the vectors of major importance are largely bloodsucking arthropods. They suck up the disease organisms along with blood from one host and in subsequent feedings transfer the pathogens to other hosts. Thus, an elementary knowledge of the internal structure and physiology of arthropods is of much interest and use to public health workers.

Development (metamorphosis). The life cycle begins with the fertilization of the egg and is completed when the adult stage is reached. The term "life span" refers to the entire length of life of the insect. Some insects, such as tropical termite queens, may live 15 to 20 years and the periodical cicada lives for 14 to 17 years. Mayflies may live only a few days as adults, although they may spend 2 or 3 years in the developing, immature stages.

Metamorphosis refers to changes in form or structure of an insect during its development. A few primitive

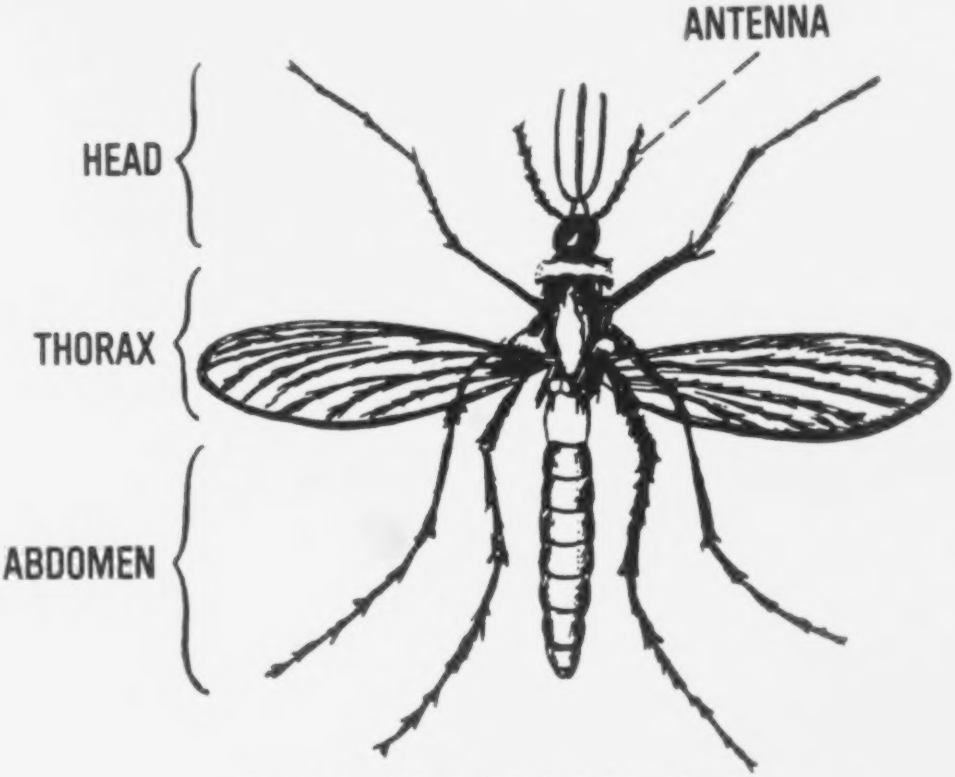


Figure 7-1. Insect (disarticulated) showing body regions.

insects develop without metamorphosis. The young possess all of the obvious structures of the adult and differ from them merely in size, color, and sexual maturity. The springtails (Collembola) and silverfish (Thysanura) develop without metamorphosis. Both are small wingless insects. The Thysanura grow and molt throughout life.

Incomplete or gradual metamorphosis. Insects with *gradual* or *incomplete* metamorphosis pass through three stages during their life: *egg, nymph,* and *adult*, as illustrated in figure 7-2. Insects in this group change gradually while going through a succession of molts to become adults. The young resemble the adult insect except for their smaller size and for the absence of wings in wing-bearing species. The young, or nymphs, are immature sexually and may bear wing pads in the latter stages of their development. Some important orders with gradual metamorphosis are:

ORTHOPTERA—cockroaches, grasshoppers, crickets, walking sticks, and mantids.
ANOPLURA—sucking lice, including the crab and body lice.
MALLOPHAGA—biting lice
HEMIPTERA—true bugs including the bed bug and kissing bug.
DERMAPTERA—earwigs.
PSOCOPTERA—book lice and psocids.

Complete metamorphosis. Insects with complete metamorphosis have four stages: *egg, larva, pupa* and *adult* (fig. 7-3) Insects with this type of life history differ greatly in the immature and adult stages. Typical larvae are the wigglers of mosquitos, the maggots of flies, or the caterpillars of butterflies and moths. The pupal stage is an important evolutionary development during which the simple larva undergoes many external and internal changes to become the complex adult.

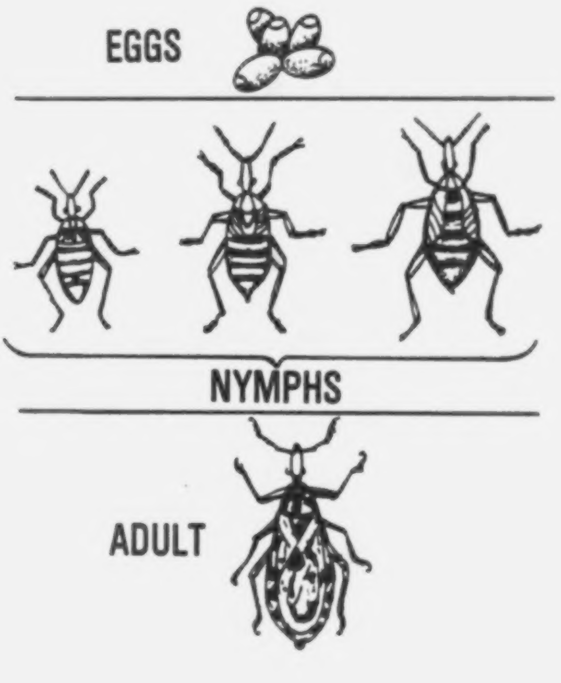


Figure 7-2. Gradual or incomplete metamorphosis.

Most of the insects with complete metamorphosis have wings as adults, but some species, such as the fleas, are completely wingless. Normally the wing buds first appear in the pupal stage. However, not all insects with complete metamorphosis have pupal "shells" (e.g., beetles and ants).

There are many orders of insects having complete metamorphosis. Five of these orders of most importance to public health workers are listed below:

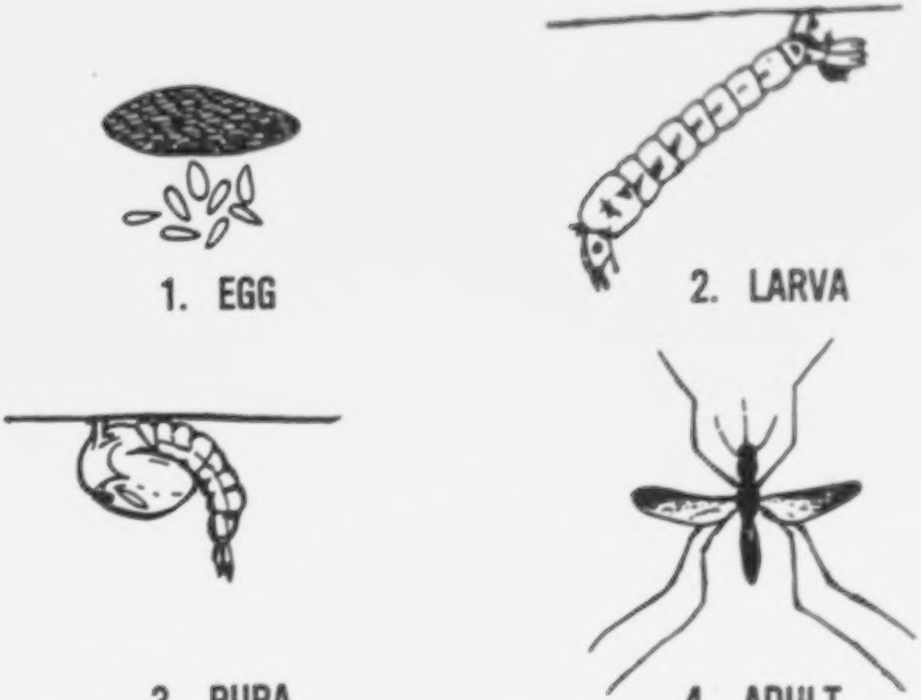
DIPTERA—flies, mosquitos, midges, and punkies.
SIPHONAPTERA—fleas.
LEPIDOPTERA—moths, butterflies and skippers.
HYMENOPTERA—ants, bees, and wasps.
COLEOPTERA—beetles.

Classification. It is necessary for public health workers to recognize important insect and arachnid pests. The accurate identification of an insect or arachnid is the key to the literature and all past work on that species. Without correct identification, serious and costly mistakes will be made in control operations. Identification of an insect serves the public health worker in the same manner that a correct diagnosis of a disease serves a physician.

It is impossible to identify an insect without the aid of an orderly arrangement or classification of species. Animals and plants are classified in accordance with a binomial system (using "two names," a generic name first, followed by the specific name), first proposed by the Swedish biologist Linnaeus in his classical book *"Systema naturae"* in 1758. Linnaeus wrote in Latin, the scholarly language of his time, and the Latin names of his major groupings have been adopted by later workers as a universal language. Thus, *Culex pipiens* means the same common house mosquito to a French, German, Spanish, Arabian or Japanese worker, regardless of ability to read these various languages. Scientific nomenclature is one of the universal languages understood and used by people throughout the world regardless of their native tongue.

Most living things are divided into the Plant and Animal *KINGDOMS.* The Animal Kingdom is made up of a number of major divisions, or *PHYLA* (singular, *PHYLUM*) (fig. 7-4). The phylum Chordata contains all the animals with a backbone, including humans and other mammals, birds, reptiles, and fish. The phylum Arthropoda contains about 96 percent of all described animal species. Members of this phylum have segmented bodies, jointed appendages, and an exoskeleton. The arthropods are divided into *CLASSES* including class Insecta-insects; class Arachnida-copepods and others; class Chilopoda-centipedes; and class Diplopoda-millipedes.

The class Insecta (or Hexapoda) includes all true in-



1. EGG

2. LARVA

3. PUPA

4. ADULT

Figure 7-3. Complete metamorphosis.

SCIENTIFIC CLASSIFICATION OF MAN AND THE HOUSE FLY

GROUP	MAN	HOUSEFLY
KINGDOM	Animal	Animal
PHYLUM	Chordata	Arthropoda
CLASS	Mammalia	Insecta
ORDER	Primate	Diptera
FAMILY	Hominidae	Muscidae
GENUS	Homo	Musca
SPECIES	sapiens	domestica

Figure 7-4. Example of scientific classification.

sects. It comprises a number of major groupings called *ORDERS* such as the order Diptera, or true flies. Each order is made up of *FAMILIES*, such as the family Culicidae, or mosquitos. Each family is comprised of one or more *GENERA*, such as the genus *Culex*, and each genus has one or more *SPECIES*, such as *pipiens*, the house mosquito, which has several *SUBSPECIES*, such as *Culex pipiens pipiens*, the northern house mosquito. Most insects have only two names, such as *Blattella germanica*, for the German cockroach, or *Cimex lectularius* for the common bed bug, but some important species do have well-recognized subspecies such as the body louse, *Pediculus humanus humanus*, and the head louse, *Pediculus humanus capitis*. Thus, the scientific name of an insect consists of either two or three Latin words, either the generic and specific name, as *Blattella germanica*, or the generic, specific, and subspecies names such as *Culex pipiens fatigans*. These names are always written in italics or are underlined. Only the generic name begins with a capital letter.

Insect Identification. Many characteristics are used to identify an insect to order, family, genus, and species. It is necessary to examine the structure of the antennae, wings, legs, and mouthparts. Frequently, very small details, such as certain body hairs, or scales, are important. Therefore, the specimens must be kept in good condition and good microscopes provided for identification. Most large insects can be identified by means of a hand lens or low-power dissecting microscope, whereas the very small species require use of a compound microscope.

The best way for you to identify some insects is with an identification key. There are several types of keys available. These keys are used mostly for the identification of species or genera of animals that closely resemble each other. Examples of keys are the written key and the pictorial key. They can be used alone or in conjunction with one another to identify the animal or insect.

Pictorial key. This is a diagram (fig. 7-5) consisting of pictures of the identifying features of the family or genus being identified. It is usually read from the top down. The pictures are connected by line in the manner of a functional chart or chain-of-command diagram. As each major identifying feature is found, the line is traced in the direction indicated by arrows to the next differentiating feature.

Written key. This is merely a brief verbal description of identifying features "listed" in a choice format. The left margin of the key is numbered consecutively from 1 to the end of the key. After each number, you will see either a name or another number. The name indicates completion of the identification. A number indicates the location in the key of the paragraph that describes the best differentiating characteristics. For example, a paragraph may list two characteristics. After each is a number. If you are identifying mosquito larvae and if the larva you are identifying has no pecten teeth and the air tube is short, conical, and sharply pointed, the genus is Mansonia. You would then go to a specific paragraph of the key for further identifying features as to species. If the air tube has pecten teeth and is not pointed, you would proceed to the next paragraph. Keys for various individual arthropods and rodents can be obtained from the Centers for Disease Control, Atlanta, GA 30333. Also, keys can be found in entomology textbooks and a variety of other sources.

Exercise (062):

1. How does the skeleton of an insect differ from humans, and what is it called?

2. Name the three main regions of a body of an insect.

3. Why is it important to have a knowledge of internal structure and physiology of insects?

4. What is metamorphosis?

5. Give examples of some important disease vectors that have "complete" metamorphosis.

6. Most living organisms are divided into what two kingdoms?

7. What are the major divisions of the animal kingdom?

8. Name two types of identification keys.

7-2. Types of Control

An insect population at your base can be controlled in three basic ways. Through physical, biological, or chemical control measures (fig. 7-6). Let's look at each of them separately.

063. Cite characteristics of physical, biological, and chemical control measures.

Physical Controls. Physical (sometimes referred to as

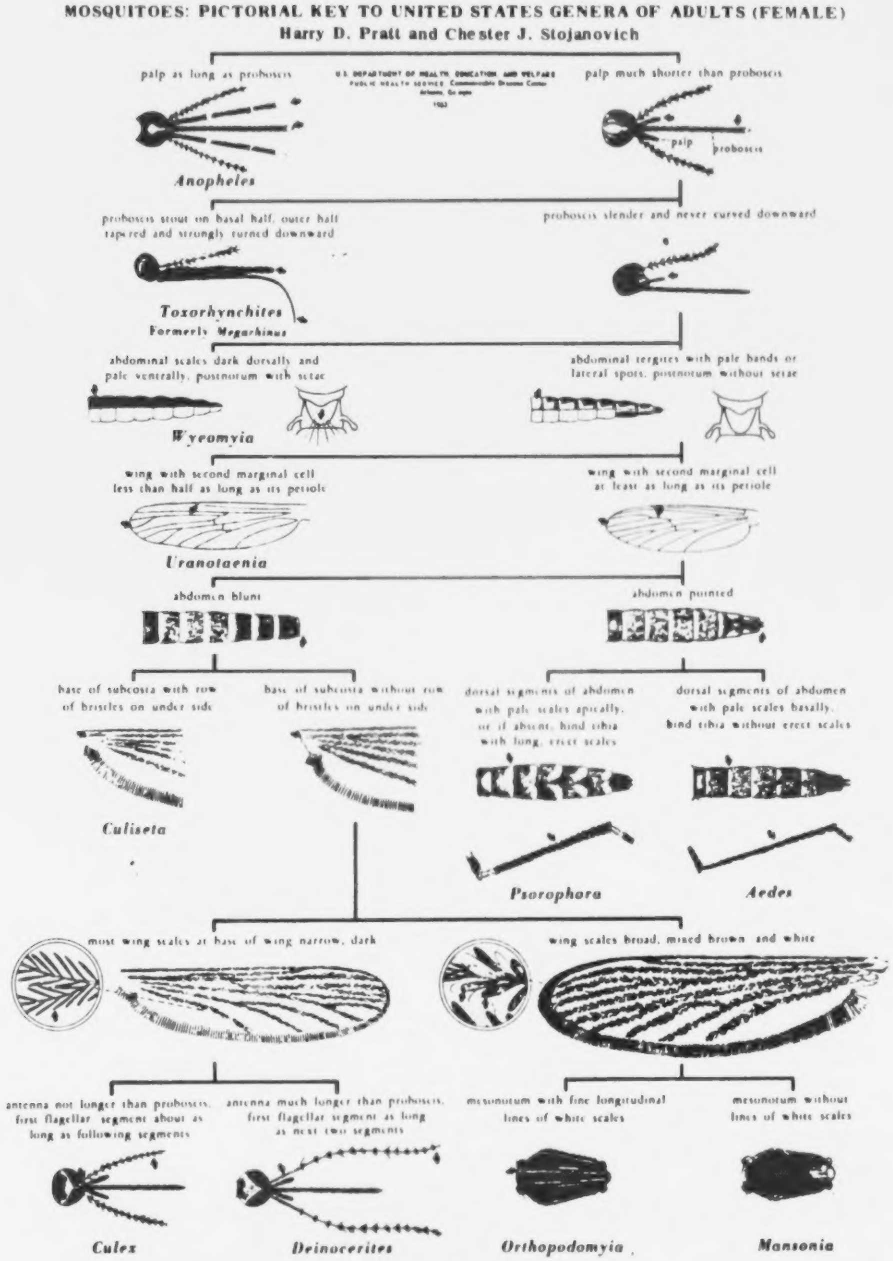

MOSQUITOES: PICTORIAL KEY TO UNITED STATES GENERA OF ADULTS (FEMALE)
Harry D. Pratt and Chester J. Stojanovich
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE Communicable Disease Center
Atlanta, Georgia
palp as long as proboscis
palp much shorter than proboscis
palp
proboscis
Anopheles
proboscis stout on basal half, outer half tapered and strongly turned downward
proboscis slender and never curved downward
Toxorhynchites
Formerly Megarhinus
abdominal scales dark dorsally and pale ventrally, postnotum with setae
abdominal tergites with pale bands or lateral spots, postnotum without setae
Wyeomyia
wing with second marginal cell less than half as long as its petiole
wing with second marginal cell at least as long as its petiole
Uranotaenia
abdomen blunt
abdomen pointed
base of subcosta with row of bristles on under side
base of subcosta without row of bristles on under side
dorsal segments of abdomen with pale scales apically, or if absent, hind tibia with long, erect scales
dorsal segments of abdomen with pale scales basally, hind tibia without erect scales
Culiseta
Psorophora
Aedes
most wing scales at base of wing narrow, dark
wing scales broad, mixed brown and white
antenna not longer than proboscis, first flagellar segment about as long as following segments
antenna much longer than proboscis, first flagellar segment as long as next two segments
mesonotum with fine longitudinal lines of white scales
mesonotum without lines of white scales
Culex
Deinocerites
Orthopodomyia
Mansonia

Figure 7-5. Pictorial key.

cultural or naturalistic control measures) involves changing the environment to eliminate potential breeding areas. Naturalistic control methods are usually more desirable than chemical control because you avoid "contamination" of the environment and also the chance of resistance to commonly used pesticides developing in the arthropod population. Naturalistic control measures have some disadvantages, however. They usually require physical alteration of an area. It may take some time to do this, so physical control measures usually don't offer immediate relief of the problem. Lastly, physical controls are usually more expensive. Even with these disadvantages, physical control measures are still the best way to try to control a vector problem at your base. Some examples of physical control measures are draining standing water, filling a marshy area, and deepening ponds.

Biological Controls. Biological control implies the destruction of the larvae by predators, pathogens, or genetic manipulation. One advantage to biological control is that the impact on the environment is much less. Examples of biological controls are top feeding min-

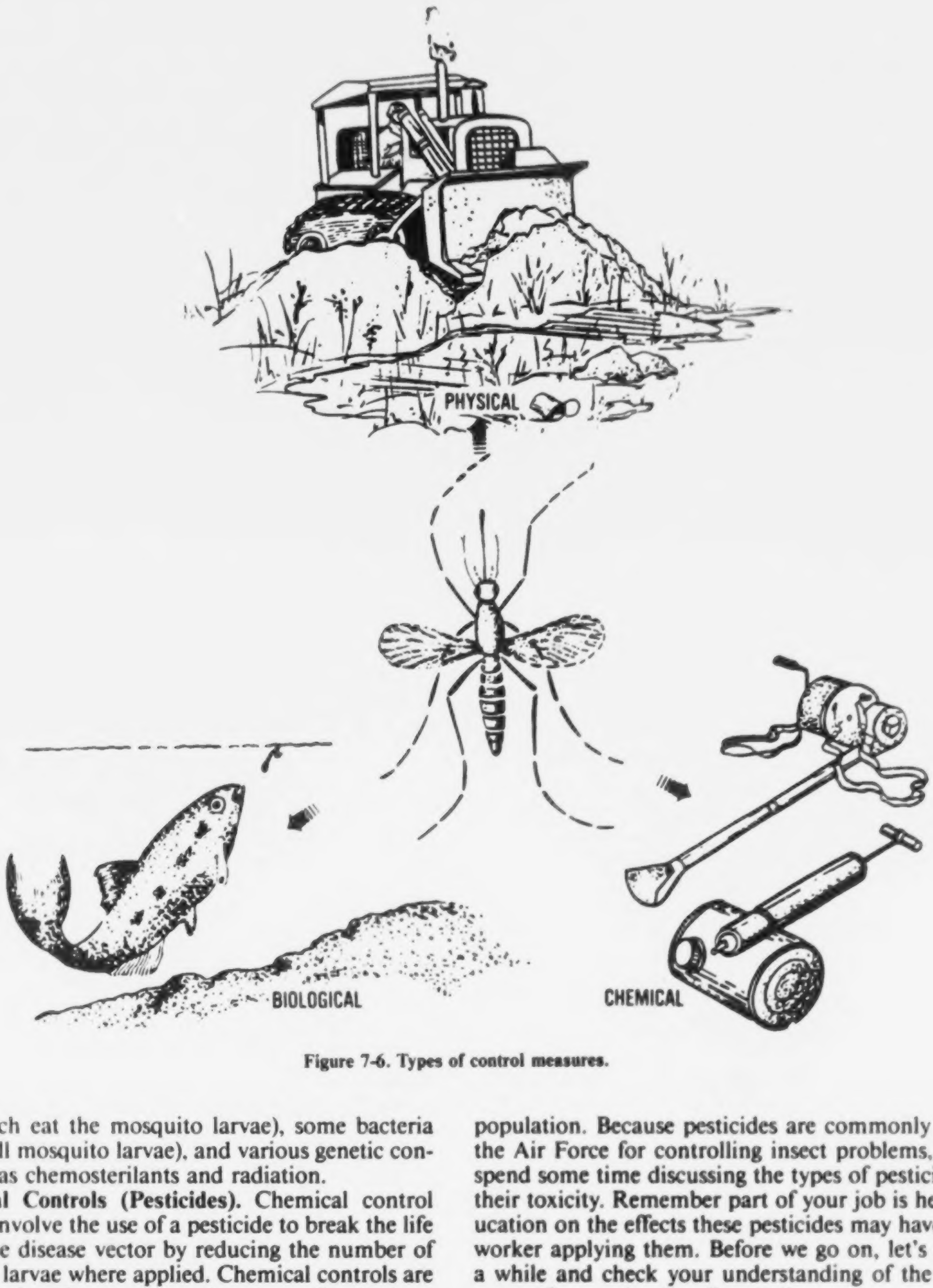


Figure 7-6. Types of control measures.

nows (which eat the mosquito larvae), some bacteria (used to kill mosquito larvae), and various genetic controls such as chemosterilants and radiation.

Chemical Controls (Pesticides). Chemical control measures involve the use of a pesticide to break the life cycle of the disease vector by reducing the number of adults and larvae where applied. Chemical controls are highly effective if properly used and usually the least expensive of the three types of control. Chemical control measures provide rapid results and are the best control if there is a disease outbreak involving a specific vector or for use at temporary bases (such as in a "field" environment). Some pesticides have a "residual effect" that could be dangerous to the environment. Additionally, if chemical controls are improperly applied, resistance problems may develop in the disease vector population. Because pesticides are commonly used in the Air Force for controlling insect problems, we will spend some time discussing the types of pesticides and their toxicity. Remember part of your job is health education on the effects these pesticides may have on the worker applying them. Before we go on, let's stop for a while and check your understanding of the various types of control we've discussed.

Exercises (063):

1. What type of control gives more permanent control and is provided by changing the environment?

2. The destruction of larvae by predators, pathogens, etc., is an example of what type of control measure?

3. Which type of control may produce "resistance" problems in the disease vector population if improperly done?

4. Cite examples of physical controls measures.

5. Cite examples of biological controls measures.

064. Cite the classifications, effects, and hazards of pesticides.

Classification of pesticides. Part of your job is to make sure that pesticides are used in a correct and safe manner. You want to make sure that pesticide workers and, perhaps more importantly, you or your family are not unnecessarily exposed to some of the most potent toxins known: pesticides.

A pesticide can be defined as, "a chemical agent used to destroy pests of any sort." Sometimes pesticides are classified by the way they are used. Examples of this classification are insecticides, rodenticides, herbicides, fungicides, molluscacides, and algacides.

Also, they may be classified by mode of action, such as stomach poisons, contact poisons, fumigants (inhalants), repellants, or attractants. The "mode of action" classification is more useful to use because they define how they get into the body, but most can get in more than one way. Of the most used medically is the chemical composition classification. In this grouping, the type of hazard posed by the pesticide is determined by the chemical composition or type classification.

It is usually convenient to consider the toxicity of pesticide chemicals under some logical grouping to avoid treating each one separately. Listed below is one of the acceptable methods of grouping pesticide chemicals, with some examples within each group.

a. Inorganic Pesticides - Arsenic trioxide, zinc phosphide, thallium sulfate, paris green.

b. Synthetic Organic Pesticides -

(1) Chlorinated Hydrocarbons - DDT, lindane, aldrin, dieldrin, chlordane, heptachlor, kepone.

(2) Phosphorous Compounds - (Organophosphates) - Parathion, malathion, diazinon, phosdrin, dichlorvos, fenthion, ronnel, naled.

(3) Carbon Compounds (Carbamates) - Carbaryl.

c. Botanical Pesticides - Nicotine, pyrethrum, rotenone.

d. Rodenticides - Warfarin, universal anticoagulant, ANTU.

e. Fumigants - Hydrogen cyanide, methyl bromide, phosphine.

Toxicity of pesticides. The toxicity of a pesticide is largely dependent on its chemical make up. From your standpoint, one of the most important aspects of insect and rodent control is the effects that the various chemicals can have on the human body. Not only can these chemicals contaminate food and beverages, but improper handling of pesticides by persons during mixing operations and application can result in serious injury and even death. Most chemical pesticides are extremely toxic if ingested and vary in their effects when inhaled or absorbed through the skin. Some also cause dermatitis from repeated exposures.

Inorganic pesticides. Most of the inorganic pesticides are formulated from heavy metals and are extremely toxic to warm blooded animals. Arsenic poisoning, for example, produces symptoms of severe irritation of the gastrointestinal tract. Chronic arsenic poisoning may result from prolonged exposure to small amounts because of absorption through the lungs, skin, or alimentary tract. Normally, workers with this pesticide are simultaneously exposed to inhalation and skin absorption. Symptoms of chronic poisoning at first go unnotices, and bronchial irritation may be attributed to infection or to smoking. Loss of appetite, nausea, vomiting, and diarrhea may be attributed to dietary indiscretions, and skin eruptions attributed to some other pesticide. Prolonged chronic exposure eventually leads to anemia, multiple neuritis of the extremities, skin changes, and even loss of hair and fingernails. Paralysis and liver damage are late manifestations. Because of the toxicity of insecticides containing arsenic and heavy metals, they may not be used by Air Force personnel or on Air Force bases without specific approval.

Synthetic organic pesticides. This chemical composition grouping includes the chlorinated hydrocarbons, phosphorous compounds, and the carbamates.

a. Chlorinated hydrocarbons. Some of the insecticides used in military pest control programs belong to this group of chemicals. Some of them are quite hazardous as concentrates, and a single exposure is capable of causing illness and death. There is a wide range of toxicity and hazard. Even repeated exposure to diluted solutions can also be hazardous. Therefore, maximum use of protective measures should be employed. Pesticides in this group of chemicals usually affect the nervous system. The result is spastic inability to coordinate muscular activity, which progresses to convulsions. If death occurs, respiratory failure is usually the immediate cause.

b. Phosphorous compounds (organophosphates). Organic phosphates have a wide range of toxicity of mammals. Malathion is slightly toxic, diazinon toxicity is moderate, and parathion is highly toxic. This group of chemicals inhibits cholinesterase, an enzyme essential to the proper functioning of the body. Mammalian poisoning from organic phosphorous pesticides affects the central nervous system. Symptoms of poisoning may include gastrointestinal discomfort, salivation, profuse sweating and difficulty in breathing. As with poisoning due to chlorinated hydrocarbons, the immediate cause of death is usually respiratory failure.

c. Carbon compounds (carbamates). The carbamates are a relatively new group of pesticides. (Several experimental compounds show considerable promise as insecticides.) Carbaryl is being used as a louse powder. Some other carbamates are used as fungicides. This group of compounds also inhibits cholinesterase and has a wide range of toxicity and hazard.

Botanical pesticides (natural organic pesticides). Nicotine pesticides, used chiefly in the control of plant pests, are highly toxic to mammals. The poison is readily absorbed through the skin. Symptoms of poisoning may appear, depending upon the concentration and duration of contact. Rotenone is another botanical pesticide which is frequently used for a variety of pest problems and as a deliberate fish poison. The mammalian toxicity of rotenone varies considerably among animal species, though precautions in its use, as outlined below, are adequate to protect humans. Strychnine, from the seeds of *Strychinos* spp., is used as a rodenticide.

Solvents. Liquid insecticides are rarely applied in undiluted form. Water is sometimes used as a solvent, but kerosene and fuel oil are also widely used. Kerosene can be dangerous to humans if not properly handled. Ingestion often brings gagging and coughing. Aspiration into the lungs may be followed by bronchopneumonia. Following the use of kerosene sprays in enclosed, poorly ventilated, spaces, there may be nausea, dizziness, coma, and other symptoms of poisoning. Kerosene dermatitis can also occur from continuous exposure.

Rodenticides. The materials in this group are inorganic and organic chemicals, but the uses and modes of action are sufficient to justify consideration of rodenticides as a separate group. Those formulated from heavy metals and plant products have been mentioned above. These have been the cause of most human poisoning associated with rodenticides. Another group of chemicals used widely in rodent-control programs today comprises the anticoagulants, derivatives of coumarin or indandione. One of the early members of this group is known as Warfarin, which is supplemented in the military supply system by other anticoagulants in water soluble formulations. In addition to causing capillary damage, these chemicals interfere with formation of prothrombin, resulting in extensive internal hemorrhages. These chemicals do, however, have the advantage of low acute toxicity. Consequently, in the concentrations recommended, repeated ingestion over a period of several days is required to produce lethal poisoning in mammals, including humans. Accidental or deliberate ingestion of these anticoagulants, particularly of the concentrates, may led to death. Depending on systemic levels reached, repeated prolonged exposure may result in disease conditions ranging from prolonged bleeding from minor cuts to serious hemorrhagic phenomena.

Fumigants. These chemicals are used for specialized problems in rodent control as well as for insect control in selected situations. Hydrocyanic acid (hydrogen cyanide or HCN) and any of the cyanides which produce HCN gas are extremely toxic to humans, causing death very quickly by stopping cellular respiration. Breathing a concentration as low as 200 parts per million of air will be quickly fatal for humans. Higher concentrations will cause more rapid death. A gas mask is not enough to protect an individual at these high concentrations for prolonged periods since the gas is readily absorbed by the skin. Fumigation with this gas in closed spaces, therefore, requires elaborate precautions in addition to the gas mask. Those applying this gas should know how to get into the open air quickly, even in the dark. Methyl bromide is rarely used in the Air Force today because of toxic residues. Phosphine is the "state of the art" fumigant for food products because there are no toxic residues. It must be applied only by specially trained pest control operators having special application equipment. It is commonly used today throughout the United States and the world. Odor cannot be relied upon as a warning of dangerous concentrations. Hazardous quantities could be inhaled before odor was detected, and because of delayed toxic action in humans, the exposed individual would not be aware of it. Onset of symptoms, followed by death, may occur as long as 48 hours after an exposure. At high enough concentrations, death can come rapidly in a matter of minutes rather than hours.

Resistance to pesticides. With the introduction of DDT as an insecticide there were hopes that most of the harmful insects could be wiped out once and for all by the use of this material. However, within a fairly short time, it became apparent that such would not be the case. It was soon noted that the use of DDT did not kill all of a given population of insects and that those which were not killed soon produced young which were not so greatly affected by DDT. After a year or two, such a population had reached a point where DDT had almost no effect. The term "resistance" was used to describe this condition.

There are approximately 56 species of insects of medical importance that are now resistant to one or more insecticides. Of these, 26 are important vectors of disease. Resistance is a particularly important problem in the United States. Houseflies have become resistant to DDT and to most of the other chlorinated hydrocarbons and are showing resistance to many of the newer phosphorous compounds. This is probably due to the very widespread use of insecticides in the United States by individuals who can buy almost any known form of an insecticide at the corner store.

If pesticide resistance in a insect population is suspected, contact the Epidemiology Division, USAFSAM, Brooks AFB, TX for insect testing and recommendations on pesticides use.

Exercise (064):

1 What are the three primary ways pesticides are classified?

2. State what pesticide classification is most useful to EHS and explain why.

3. What effect does the rodenticide Warfarin have on the body?

4. What groups of chemical compounds inhibit cholinesterase?

5. State two examples of fumigants.

6. What term is used to describe when a pesticide (because of improper application) no longer has a "killing" effect on a vector population?

7. Whom can you consult concerning resistance of a vector population to a specific pesticide?

7-3. Mosquitos

On a worldwide basis mosquitos are responsible for the transmission of disease to millions of people each year. Although most mosquito-borne diseases occur in the tropics, some do occur in the United States. Add this to the fact that the military is deployed worldwide, and you can see that understanding the mosquito is very important.

065. Cite characteristics of the biology of mosquitos and the diseases they transmit.

Mosquito Biology. Understanding mosquito biology is essential for effective surveillance and control programs. This section includes a general overview of the classification and bionomics of mosquitos.

Classification. Mosquitos belong to the most abundant group of invertebrate animals, the insects. Within the Class Insecta, they are further categorized to the Order Diptera and Family Culicidae. The following scheme summarizes the taxonomic position of mosquitos (specifically, the anopheles mosquito).

Kingdom: Animalia
  Phylum: Arthropoda
    Class: Insecta
    Order: Diptera
      Family: Culicidae
        Subfamily: Anophelinae (anaphelines)
          Genus: Anopheles

Subfamily: Culicinae (culicines)
  Genera: Aedes
    Coquillettidia
    Culex
    Culiseta
    Deinocerites
    Haemagogus
    Mansonia
    Orthopodomyia
    Psorophora
    Uranotaenia
    Wyeomyia

Subfamily: Toxorhynchitinae
  Genus: Toxorhynchites

Mosquito bionomics. In order for you to understand the life cycle of the mosquito we need to look at the characteristics of the adult and larvae. (fig. 7-7).

Adult. Adult mosquito populations are usually about half males and half females. The males ordinarily emerge first and remain near the breeding site where they mate with the later-emerging females. Only the females bite, and in most species a blood meal is required before eggs are produced. Females tend to travel greater distances and live longer than males.

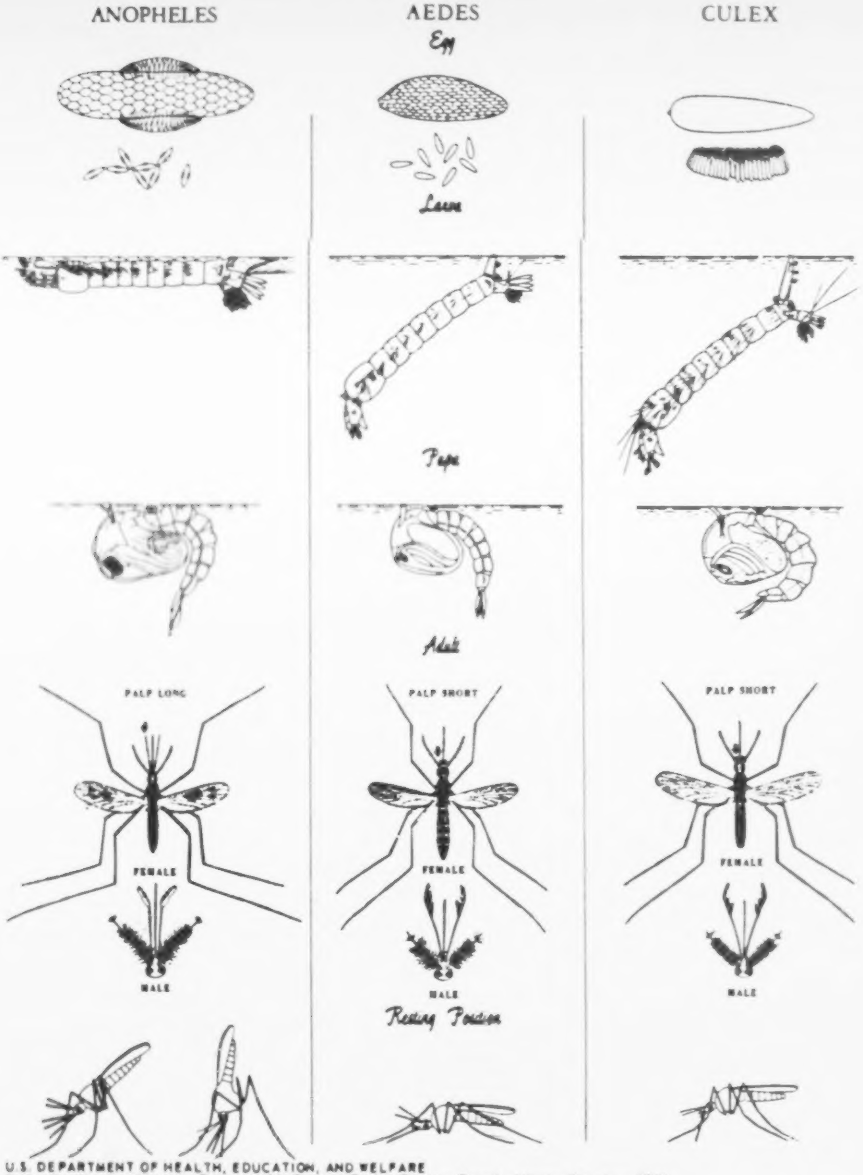
Flight habits vary according to species and are affected by such diverse factors as wind speed and host availability. In the United States, *Aedes Aegypti* fly only short distances (100 yds) because it usually breeds in and around human dwellings. Most anophelines have a maximum flight range of about 1 mile, but some culicine species, such as *Aedes sollicitans,* travel 20 miles or more.

Female mosquitos feed upon a wide variety of animal hosts ranging from coldblooded amphibians to humans. Host selection is determined by a combination of host availability and by the innate host preference of the particular mosquito species. Species of the subfamily Toxorhynchitinae do not blood feed but subsist entirely upon nectar or other plant exudates. Daily biting activity varies according to species and season. Some mosquitos bite mainly during the day, others mainly at night, while still others show maximum activity during dusk and dawn.

Accurate estimates of the average life span of the adult stage have been determined for only a few species. Estimates range from a few days for some to more than 6 months for overwintering forms.

Larvae. Mosquito larvae are found in virtually all kinds of aquatic environments except rapidly flowing streams and deep, open waters of lakes and seas. Typical larval habitats include permanent ponds and marshes, temporary pools, tree holes, plant axils and leaves, and artificial containers. Larvae feed upon smaller organisms and debris in the water. All mosquito larvae must come to the surface of the water for air except those in the general *Coquillettidia* and *Mansonia*, which obtain air by piercing the underwater portions of plants.

The larval period, which consists of four developmental instars, requires from 4 days to many months to complete, depending upon the species and environmental conditions. Mosquito larvae molt (shed their



MOSQUITOES: CHARACTERISTICS OF ANOPHELINES AND CULICINES
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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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Figure 7-7. Example of a pictorial key illustrating mosquito characteristics.

skins) at the end of each instar. The final (4th) instar molts to become a pupa—a nonfeeding transitional stage between the larva and the adult.

Mosquito larvae swim in two different ways: by undulations of the body and by propulsion with mouth brushes. When near the top of the water, anopheline larvae lie parallel to the surface and move by undulating, while culicines hang head down and move by using their oral brushes.

Larvae are affected by both the abiotic (physical and chemical characteristics) and biotic (other organisms) factors of the water in which they develop. Abiotic factors such as temperature, light penetration, salinity, and gas content may limit development. Important biotic factors include pathogens, parasites, predators, competitors, and protective vegetation.

Mosquitoborne Diseases. In the past, most of mosquitoborne diseases were highly important as endemic or epidemic diseases in the United States, but presently only the encephalitides occur with some frequency in this country. However, disease potential is always present. Dengue and yellow fever are at our southern door, and the malaria potential is very high since we have the vector which transmits it (*Anopheles sp.*). Some of the important mosquitoborne diseases we will cover are encephalitis, dengue, yellow fever, malaria, and filariasis.

Encephalitis. There are many forms of encephalitis throughout the world. Usually they are named for the geographical area in which they were first discovered (Japanese B encephalitis, Venezuelan encephalitis, and St. Louis encephalitis). They are viral diseases which usually affect the central nervous system (brain and spinal column). Some of the encephalitides are transmitted from birds or small animals to humans by mosquitos. Vaccines are not routinely available. Thus, personal protective measures such as the use of repellents and bed nets are of importance in the prevention of this group of diseases.

Dengue fever. The term dengue (also called breakbone fever) refers to a group of viral diseases which are widespread throughout the tropical areas of the world. This disease, which is of great military significance, is transmitted by Aedes mosquitos. Often the only symptom is a mild fever, but there may also be severe muscular pain. A vaccine is available for this disease but is not routinely used. The best means for avoiding dengue fever is the prevention of mosquito bites by using individual protective measures.

Yellow fever. Yellow fever is a viral disease now confined to tropical Africa and tropical Americas. The virus is transmitted by the *Aedes aegypti* mosquito (transmission cycle: mosquito-human-mosquito). In the jungles of the tropics, it is transmitted by the Haemagogus mosquito (transmission cycle: monkey-mosquito-monkey with humans as an alternate host). Yellow fever is characterized by fever, headache, backache, jaundice, and internal bleeding. The most important preventive measures include the administration of a highly effective vaccine and the application of individual protective measures.

Malaria. Although the occurrence of malaria is rare in the United States, it occurs very commonly in most tropical, subtropical, and semitropical areas of the world. Malaria is caused by a protozoan parasite carried by the Anopheles mosquito. This parasite destroys the blood cells and causes chills, fever, weakness, and anemia. Unless the disease is treated promptly and properly, it may cause death from damage to the brain. The only sure way of preventing malaria is to avoid the bites of infected mosquitos. When complete mosquito control is difficult or even impossible, such as during periods of active combat, the prevention of malaria is dependent upon the application of individual protective measures and the use of antimalarial drugs (chemoprophylactic treatment).

Filariasis. Filariasis is transmitted by the *Culex pipiens* and other mosquitos. Control of this disease involves mosquito control.

Exercises (065):

Identify the questions that are true. Correct any false statements.

___ 1. Mosquitos belong to the class Insecta, order Diptera, and family Culcidae.

___ 2. Only the female mosquitos bite and all subfamilies require a blood meal before eggs are produced.

___ 3. All mosquito larvae must come to the surface for air.

___ 4. The larval period consists of four developmental instar stages.

___ 5. Anopheline larvae lie parallel to the water surface.

6. Match the characteristic of the disease in column A with the disease it describes in column B. Some items in column B may be used more than once.

Column A

___ (1) Normally an infection of birds or small animals.
___ (2) Also called breakbone fever.
___ (3) Has a transmission cycle of monkey-mosquito-monkey with man as an alternate host.
___ (4) Mosquito control involves source reduction (elimination of breeding areas and adulticides).
___ (5) Drugs for chemoprophylactic treatment.
___ (6) Has an effective vaccine for prevention.
___ (7) Caused by a protozoan parasite.

Column B

a. Encephalitis.
b. Dengue fever.
c. Yellow fever.
d. Malaria.
e. Filariasis.

066. Describe mosquito surveillance methods.

Mosquito Surveys. The mosquito populations and factors affecting those populations vary from one base to another. A surveillance program on one base may not be adequate for another. One must take into account species diversity, habitat variations, climatic conditions, geographic variability, effectiveness of various survey techniques, etc., when developing a surveillance program.

Before establishing or revitalizing a program, a baseline ecological survey of the entire installation should be conducted. Consult a base map that shows drainage and mark on it the wind patterns to help locate active or potential breeding sources as well as likely sites for mosquito-trap placement. Trap sites should be between the populated areas (such as housing units and flightlines) and mosquito breeding sources. After you have identified breeding sources and have placed your traps, indicate their positions on an installation map as part of your permanent record of your surveillance program. (Fig. 7-8.)

Operational surveys are accomplished to evaluate the continuing effectiveness of the control measures. We will look at the types of surveillance methods for adults and the larval stages of mosquitos.

Adult mosquito surveys. Surveillance for adult mosquitos may be accomplished by several methods. The five primary ones we will address are: (1) Light-baited New Jersey traps, (2) Carbon dioxide (CO_2) baited New Jersey traps, (3) CDC miniature light traps, (4) Army miniature solid state light traps, and (5) resting collections.

Light-baited New Jersey traps. Most mosquitos are collected using the light-baited New Jersey traps. Although many species are attracted to light (phototactic), the fact that certain mosquitos, including some important vector species, are not phototactic must be considered when interpreting light-trap data. To maintain a standard that will allow seasonal or locality comparisons, the same type and size bulb (40–60 watt recommended) should be used consistently. As they are

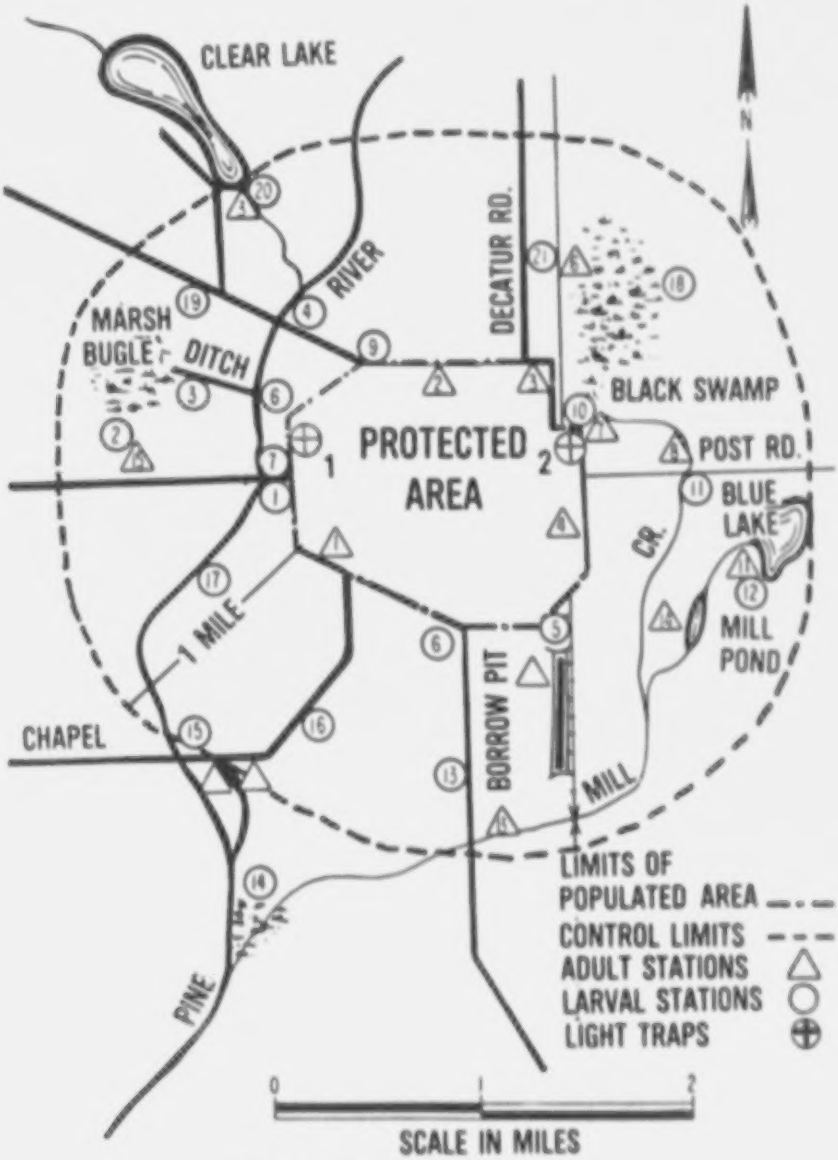

Figure 7-8. Mosquito baseline survey map.

collected, specimens are killed by vapors from a 2 inch by 2 inch piece of Vapona (No-Pest) strip at the bottom of the plastic collection jar. To prevent the specimens from contacting the Vapona, either the insecticide strip should be loosely wrapped with paper or a perforated paper or plastic cup should be placed in the neck of the collection jar to retain the mosquitos. Light traps attract mosquitos best when the light source is placed about 6 feet above ground in an area sheltered from wind and away from sources of light. A minimum of three traps per installation should be operated from dusk to dawn, 2 to 4 nights per week during the mosquito season.

CO_2-baited New Jersey traps. Traps baited with CO_2 (fig. 7-9) have several advantages over light-baited traps: (1) More mosquito species are attracted to CO_2 traps, (2) Larger numbers of mosquitos are usually attracted with CO_2 and (3) CO_2 does not attract trash insects and male mosquitos (which saves the time normally required to sort out the female mosquitos).

A standard New Jersey trap can be easily modified into a CO_2 trap. The only changes necessary are to remove the bulb and to connect a Tygon or rubber tube from a CO_2 source to the underside of the rain cover. The CO_2 can be supplied in three ways. The easiest way under field conditions is to use blocks of dry ice in an insulated container. The container may be a styrofoam shipping container or a steel ammunition box lined with styrofoam. CO_2 can also be obtained from a gas cylinder. While such a cylinder is not easily transported, once in place, CO_2 output can be precisely regulated and monitored. The CO_2 cylinder should be run at 25 ml/min. A device for generating CO_2 can also be attached to the trap. It uses propane which is catalysed by a platinum wire to CO_2. At present the propane generated CO_2 is available from commercial sources and is being tested by the epidemiology division and other DOD agencies for Air Force use.

The CO_2-baited trap, like the light-baited trap, can be operated from dusk to dawn to capture night-flying mosquitos; but unlike the light-baited trap, it can also be operated during daylight hours to capture diurnal species. If the CO_2-baited trap is operated around the clock, the dry ice will probably need replacing every 12 hours. You should supplement your light trapping program with CO_2-baited traps as much as possible in order to survey for vector/pest species not readily attracted to light.

CDC miniature light traps. The Centers for Disease Control have developed a small and easily transportable light trap (fig. 7-10) which consists of three main parts—a transparent plexiglass cylinder, an aluminum or plastic rain cover, and a nylon-mesh collection bag. A light source (flashlight bulb) and a small electric fan are mounted inside the cylinder. The principles of operation are identical to those of the New Jersey trap. Power is supplied by either four D-cell (flashlight) batteries

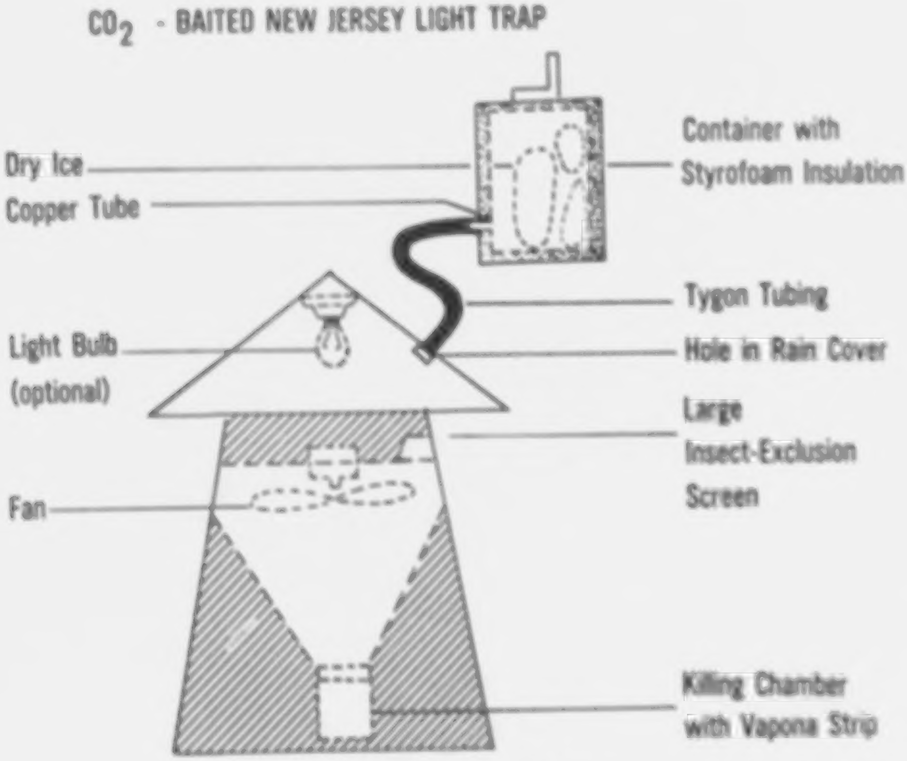
CO2 - BAITED NEW JERSEY LIGHT TRAP
Dry Ice
Copper Tube
Container with Styrofoam Insulation
Tygon Tubing
Light Bulb (optional)
Hole in Rain Cover
Large Insect-Exclusion Screen
Fan
Killing Chamber with Vapona Strip

Figure 7-9. CO_2 - baited New Jersey.

CDC MINIATURE LIGHT TRAP

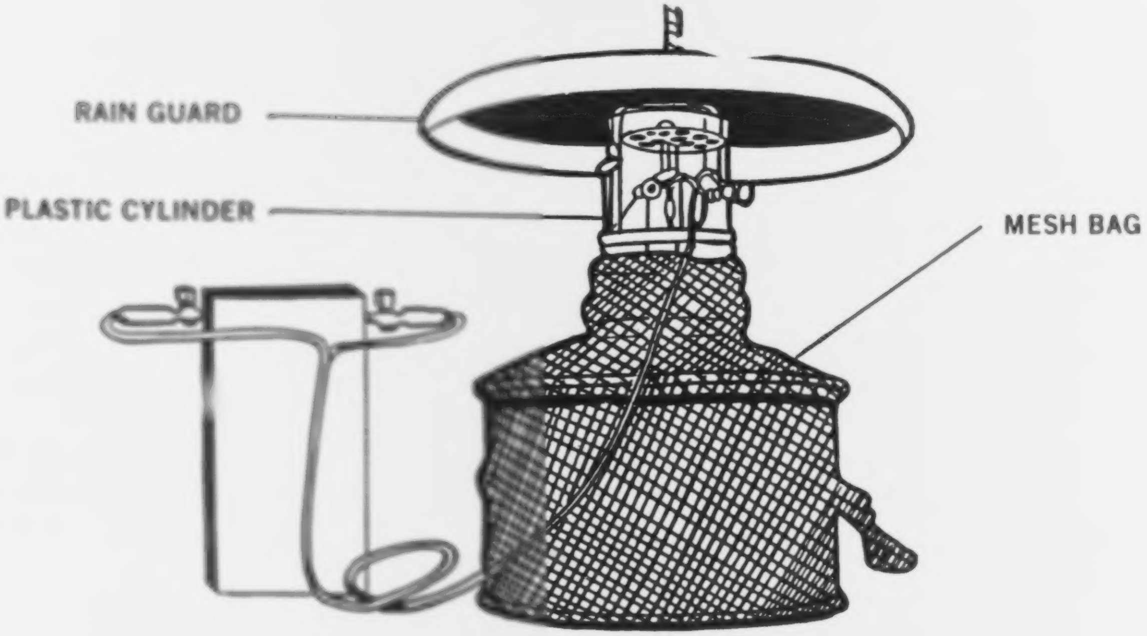

Figure 7-10. CDC miniature light trap.

attached to the outside of the cylinder, or by a 6-volt wet- or dry-cell battery. The assembled trap is about 18 inches high and weighs less than 5 pounds. The rain cover, cylinder, and collection bag disassemble to increase portability and ease of storage.

CDC traps are useful surveillance tools in areas where ground power is unavailable such as wooded areas, fields, and marshlands. Use these traps in large, undeveloped areas to insure thorough surveillance of mosquito vectors.

Army miniature solid-state light traps. The United States Army Applied Research Division at Ft. Detrick has developed a miniature light trap that has replaced the CDC trap in the Federal supply system. The key features of this trap are solid-state circuitry, a rechargeable gel cell battery, and a photoelectric switch. Refer to *USAFSAM/EKED Medical Entomology Review*, April 1982, for more information on this type of trap.

Resting collections. Many mosquitos are active only during the night and seek shelter in dark, quiet places during the day. If these resting places can be discovered, many mosquitos can usually be collected with a minimum of effort. Natural mosquito resting sites include animal burrows, privies, human habitations (drain pipes, old tires, empty floor pots, etc.), tree holes, culverts, and sheltered areas under bridges. Artificial resting sites (12 inch by 12 inch by 12 inch wooden boxes painted red inside) may be placed near bushes, forests, swamps, or similar sites, to collect adult mosquitos seeking shelter in them. Since most resting sites are dark, a flashlight is useful when collecting the mosquitos with a battery-powered aspirator.

Monthly mosquito surveillance activities summary. Each base should submit a monthly mosquito surveillance activities summary at the end of each month during the mosquito season. A sample format for this summary can be obtained from the USAFSAM; Epidemiology Division, Brooks AFB, TX 78235. List every date that each trap was run even if no mosquitos were collected on some nights. This information is necessary for calculating trap indices. Only adult mosquito collections should be included on this summary sheet.

Immature mosquito surveys. Immature mosquitos may be collected for identification from either larval or ovitrap collections.

Larval collections. Larval breeding sites should be marked on a base map and sampled at least semimonthly (frequency depends upon location of base and environment of the area) during the mosquito season. Breeding sites include tree holes, artificial containers, catch basins, temporary pools, roadside ditches, ponds, swamps and marshes. Although most larval collecting is done with a white dipper, a large bulb pipette or syringe may be necessary to sample water receptacles with small openings such as tree holes or certain artificial containers. Larval surveys show the exact areas where mosquitoes are breeding and consequently where control is needed. Also, when larval identifications are analyzed in conjunction with adult records, you can often determine whether your base is producing its own mosquito problem or whether adults are invading your base from surrounding areas.

Ovitrap collections. Aedes aegypti is important in the United States because of its potential for transmitting dengue and yellow fever. This species is usually not collected in light traps. Because *Ae. aegypti* females prefer to lay their eggs inside small dark containers, the United States Public Health Service developed the ovitrap as a surveillance tool. This trap consists of a 2-pint widemouth jar painted black on the outside and filled with about 1-inch of water (fig. 7-11). An oviposition site, called a paddle, is made by wrapping paper toweling around the lower half of a tongue depressor and fastening it to the side of the jar. A 1-inch wide strip

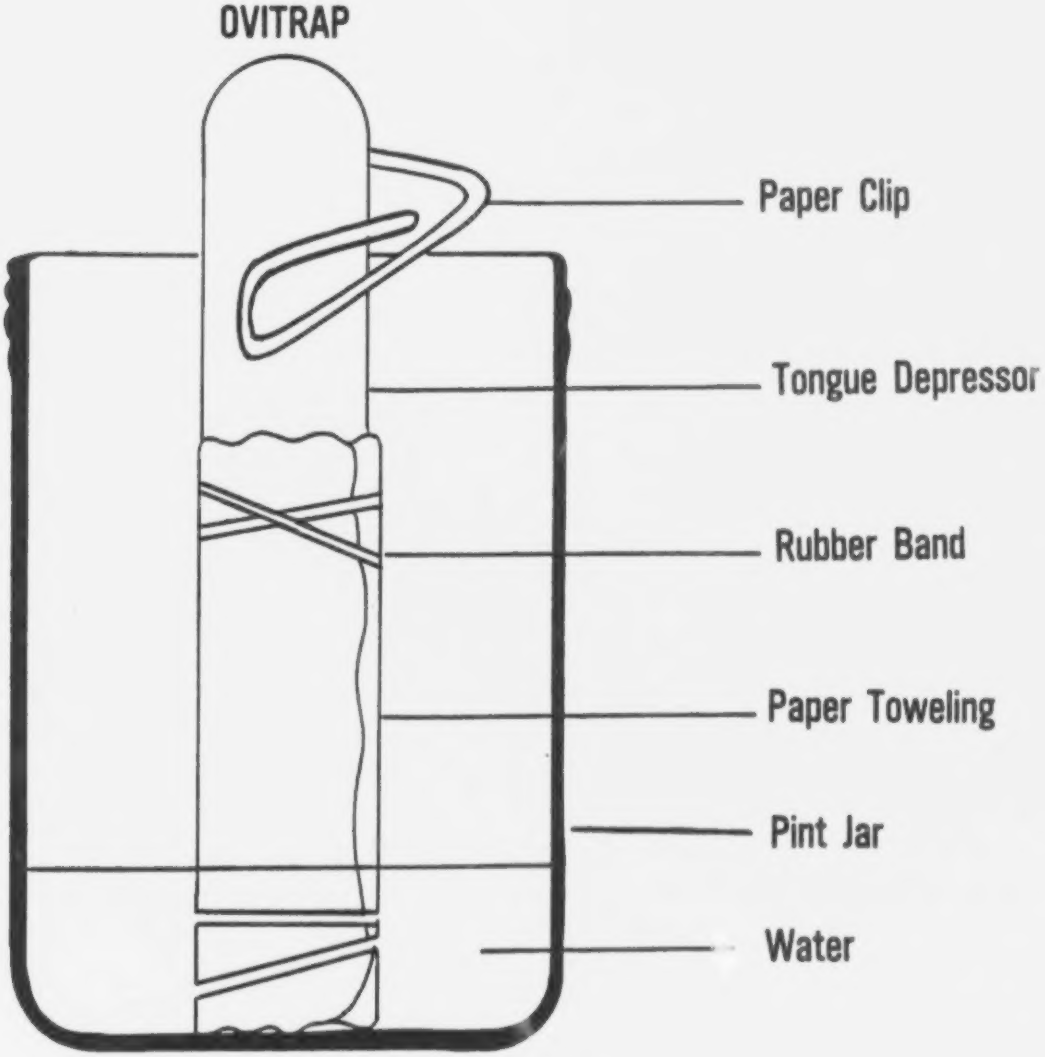

Figure 7-11. Ovitrap.

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of red velour paper may also be used as an oviposition site.

Ovitraps should be placed at ground level in sheltered, dark areas such as under bushes near houses. Enough ovitraps should be deployed to survey all the densely populated areas on the installation. Alternately, 10 ovitraps may be used for a week or two in one section of the base and then moved to other areas during subsequent weeks. The location of each jar should be carefully documented so that all can be checked each week. Remove the paddle and package it for shipment. Water in the traps should be examined and any late instar larvae sent to the Epidemiology Division USAFSAM, Brooks AFB, TX for identification. Larvae of several mosquitos besides *Ae. aegypti* may develop in such jars. Rinse out the jar and add fresh water and a new paddle.

Although ovitraps are not a stock-listed item and usually cannot be obtained locally, they can easily be made (i.e., paint a jar black with enamel paint). In addition, the Epidemiology Division has a limited supply (obtained from CDC) if needed to get your program started.

Packing and shipping mosquito specimens. Improper packaging and shipping of specimens make it very difficult for the epidemiology division to provide fast, accurate identifications. Some specific problems they have encountered include:

a. Damaged specimens caused by crowding or improper packing (no mosquito should touch any other specimen).

b. Stale specimens (they snould not be held for more than 2 to 3 days before shipping).

c. Male mosquitos (fig. 7-12) and nontarget insects included in collections.

d. Incompletely labeled containers.

e. Incorrectly addressed shipments.

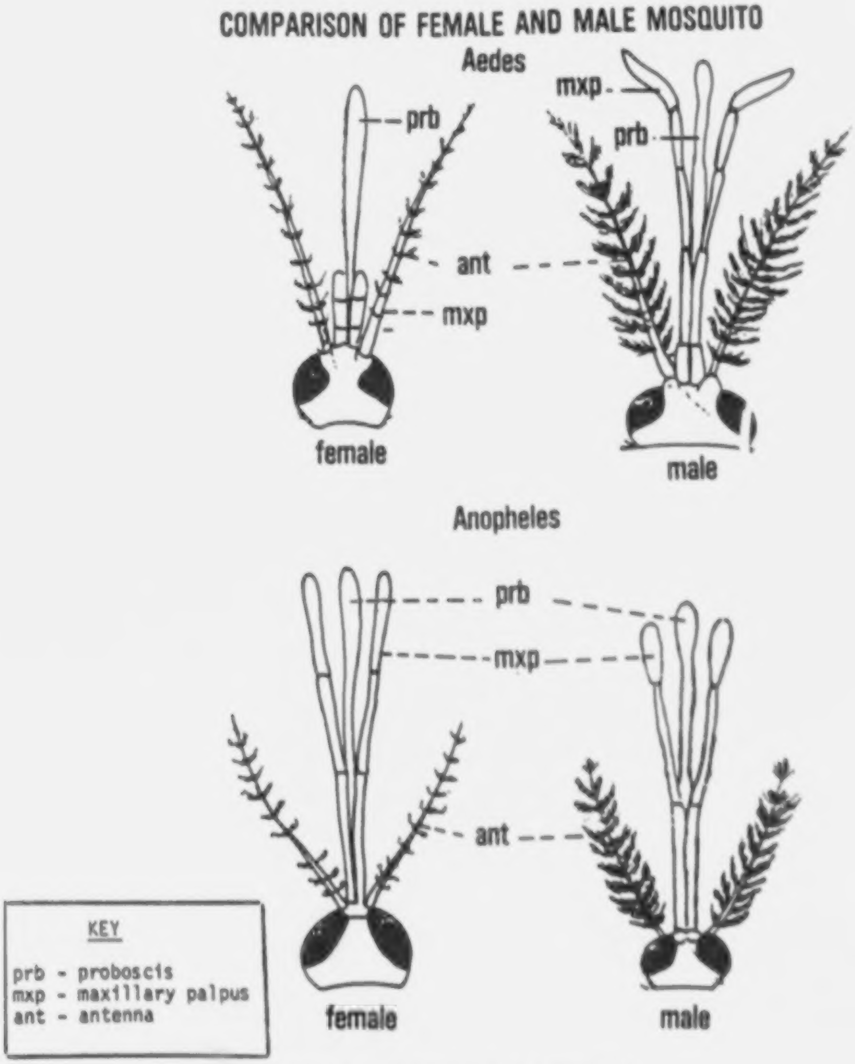

Figure 7-12. Comparison of female and male mosquitos.

Specimens should be packed as described in the *Epidemiology Division's Specimen Management Handbook* which can be ordered from USAFSAM/EKED, Brooks AFB, TX 78235.

Exercises (066):

1. Most adult mosquito species are collected using which method?

2. In interpreting light trap data, what is an important factor to remember?

3. What are three advantages of using carbon dioxide with the New Jersey traps?

4. What is the purpose of larval surveys?

5. The ovitraps are effective for the surveillance of which mosquito species?

067. Describe how the trap index is used to evaluate control operations.

Surveillance Data. The primary goal of your adult mosquito surveillance program should be to detect and monitor pest/vector species in the populated areas of the base. Surveillance data generated by the trapping program can be used to predict peak periods of mosquito abundance and to evaluate control operations. The trap index (TI) is a useful tool for organizing trap data and comparing different time periods or locations. The TI is simply the average number of females per trap night. The formula for computing a TI for a given time interval is:

$$\text{TI} = \frac{\text{Total females trapped}}{\text{Total trap nights}}$$

Note that a trap night equals one trap operated for 1 night. Data from malfunctioning traps should not be included in the calculations.

An example of how to calculate weekly trap indices is given below. Assume that a USAF installation operated four light traps for three nights during the first week in August and collected the indicated number of female mosquitos.

Date	*Trap No.*	*No. of Female Mosquitos*
2 Aug.	1	8
	2	24
	3[a]	0
	4	13
4 Aug.	1	6
	2	30
	3[b]	9
	4	0
5 Aug.	1	11
	2[c]	5[c]
	3	5
	4	11

[a] Although no female mosquitos were collected, the trap was operating and is included in the trap-nights count.

[b] Trap was inoperative and must be subtracted from trap-nights count.

[c] Trap malfunctioned and must be subtracted from trap-night count. Female specimens collected before malfunction are not to be included in the total number collected (but they should be submitted for identification).

The weekly TI would be calculated as follows:

$$\text{TI} = \frac{8 + 24 + 0 + 13 + 6 + 30 + 0 + 11 + 5 + 11}{(4 \text{ traps} \times 3 \text{ nights}) - 2}$$

$$= \frac{108}{10} = 10.8$$

Another type of trap index, the Specific Trap Index (STI), can be used to show population fluctuation in a single species or particular group of mosquitos. This type of index is particularly useful in plotting fluctuations in local pest species or disease vectors. An example of a STI calculation is the following:

For *Aedes vexans* (primarily a pest species)

$$\text{STI} = \frac{\text{No. female Ae. Vexans trapped in 1 week}}{\text{Total trap nights for that week}}$$

As weekly TIs are calculated, they should be plotted on a graph to supply a visual picture of population fluctuations. Annual graphs of the weekly TIs allow observers to identify and predict peak periods of mosquito activity. Any reasons for fluctuations in TIs that are known (such as abnormal weather or aerial spray) should be documented on the graphs. In addition, TI graphs are valuable when planning mosquito control.

Exercises (067):

1. How are trap indexes useful?

2. Define a "trap night."

3. How do we calculate a trap index?

4. How can specific trap indexes be used?

5. In the following example, calculate the weekly trap index.

Date	*Trap No.*	*No. of Female Mosquitos*
9 Oct	1	7
	2	22
	3[a]	0
	4	11
10 Oct	1	2
	2	10
	3[b]	8[b]
	4	0
11 Oct	1	10
	2[c]	4[c]
	3	3
	4	9

TI = ____________.

The special notations a, b, c are the same notations (situations) as the example given in the text.

068. Describe mosquito control methods.

Mosquito Control Methods. There are three types of mosquito control: cultural, chemical, and biological. As a general rule, the preferred method is one that involves cultural control, which is usually aimed at the elimination of water so that the mosquitos have no place to breed. Chemical control measures, on the other hand, are temporary in nature and are aimed at directly killing the mosquitos, whether they are larvae or adults. Biological control methods are not as widely used as the chemical and physical means, nor are they as well developed. It may well be, however, that future control practices will lean more and more toward the biological method.

Cultural control. Cultural methods for the control of mosquitos are often quite expensive in initial cost. Since the Air Force must operate on a year-to-year financial basis, cultural methods are sometimes abandoned in favor of less expensive control methods. Nevertheless, they are usually less expensive in the long run and should be carried out when and where possible.

One of the best methods of cultural control is filling low areas containing water. This usually requires the use of considerable amounts of heavy equipment, such as bulldozers and graders, and is the responsibility of civil engineering. The responsibility of the medical service in this connection lies in making recommendations as to areas that should be filled. A minor amount of supervision and inspection by the medical service can be required to assure that filling does not create additional problems such as a fill which serves as a dam for water coming from further upstream.

Drainage of water is widely used for mosquito control. However, it requires more maintenance than filling and should be done only if the latter method cannot be used. Draining and ditching are often used with filling, especially in irrigated areas where waterflow can cause temporary ponds in low ground. Draining and ditching are used frequently in salt-marsh areas. These ditches are designed to take advantage of tides to periodically flood and drain breeding areas. Underground drains may be required in marshes and swamps. This is appropriate where the soil is impervious and does not allow water to pass to lower areas.

There are a wide variety of other cultural control methods. These include filling tree holes; eliminating cans, bottles, and other receptacles that hold water; using flood gates across small streams; and screening with fine-mesh screen. A 24-mesh screen is necessary for exclusion of some small species. The standard issue screening meets the requirements for exclusion of mosquitos. Complaints that mosquitos are coming in through the screen are usually because of holes in the screens or improperly installed doors and windows. A close inspection of the fit of such openings usually indicates a need for changing doors, patching screens, or replacing weather stripping.

Chemical control. Chemical control measures for mosquitos are temporary in nature. They must be repeated at frequent intervals during the breeding season. Such measures should only be used in addition to permanent cultural control procedures and are directed at either larvae or adults.

Chemicals used for the control of mosquito larvae are called larvicides. Larvicides work primarily through a chemical action of poisoning or through a combination of physical and chemical action to prevent larvae from breathing. Eggs are not greatly affected by larvicides unless they become coated with oil. Pupae are affected only if they are cut off from air.

Larvicides can be applied as dusts. In this case, the action is toxic with the larva feeding on the particles of insecticides. Because of their particulate nature, dusts do not lend themselves to an even distribution on the surface of the water. They tend to be accumulated in certain areas by waves and wind action. The dust particles can be harmful to fish. They do not generally affect plant life in the water. If applied among emergent vegetation around the edges of ponds, dusts will remain for a considerable length of time.

Dusts are used in some areas for prehatching treatment. Here they are applied to frozen ponds or snow-covered low spots which become temporary pools in the spring. Thus, an insecticide is present when overwintering eggs hatch and early control is gained. Dusts are generally applied with a rotary duster, which is hand-carried and hand-operated. Dust should be applied from the upwind side so that the wind will carry the insecticide over the breeding area and not blow back into the face of the operator. It is generally directed downward toward the surface of the water unless it is desired to reach an area at some distance.

Granular larvicides have come into widespread use in the past few years. They are apparently quite effective because they dissolve rather slowly and poison the water in the area to which they are applied. Liquid sprays applied to the surface of the water serve as a larval poison. In addition, if in an oil base, they can coat the surface of the water with a film which the larvae cannot penetrate with its breathing tube. When this happens, the larvae drown. Sprays may have less toxic effect on fish than dusts. However, they can injure plant life. In the long run, this can have a worse effect on the entire pond than would dust because killing the plant life would lower the amount of oxygen in the water. Sprays should be directed toward the areas where emergent vegetation makes good hiding places for mosquito larvae and along the edges of the water area where the depth is not great. The entire surface of the pond should not be sprayed (or dusted) unless the area is very small and unless the overall water depth is quite shallow.

Chemical control of adult mosquitos is achieved in one of two ways; application of residuals on surfaces where the mosquitos can rest, or direct application to the insect by spraying the space which it occupies. Dusts are seldom used for control of adult mosquitos, although some results can be gained through the residual action of dust applied to wet vegetation. No practical method of using granules for this purpose has been found.

Residual sprays for the control of adult mosquitos can be applied on indoor walls, on exterior surfaces of buildings, or on vegetation. Residuals are generally used as oil solutions, or water emulsions, so that the insecticide will remain in crystalline form after the liquid evaporates. However, when sprayed on vegetation, residuals in the form of suspensions or weak emulsions are used to prevent the burning of foilage. Residual insecticides, particularly indoors, are long lasting and can give good control for several months.

Space spraying is usually carried out in closed areas by the use of aerosol bombs, or microsol sprayers, the same as for houseflies. Outdoor space spraying requires the use of fog or mist machines. Adult mosquitos are quickly killed by this method, but the effect is not long lasting because there is almost no residual effect.

Dispersals of liquid insecticides from aircraft will give some control of adult mosquitos for a short time. The effect is partly that of a space spray combined with some residual action.

Biological control. Present biological control methods are those methods that reduce the mosquito population through predators, parasites, or disease. A predator, as far as mosquito larvae control is concerned, can be defined as any animal that feeds upon mosquito larvae reducing reducing their number. There are many predators in nature such as larvae of various insects, notably young dragonflies, which feed on mosquito larvae. Generally speaking, it is not practical to try to stock an area with such insects; but if there is a large supply of them present, efforts should be made not to hinder them. For example, shoreline spraying and similar measures which might kill the adult dragonflies might be avoided. The adults, thus preserved, not only produce more young, but are themselves predatory on adult mosquitos.

One of the most widely used predators is a small top-feeding minnow, *Gambusia affinis*. This fresh-water minnow can be purchased alive for mosquito control and will feed on larvae along the shallow edges of the stream. Fundulus species serve the same purpose in salt water. Another predator which is used widely is the *Tilapia mossambica* and other Tilapia species. These are of the Cichlid family of tropical fresh water fishes. Stocking waters with such fish requires approval of federal and local wildlife and fishery agencies.

There are many mosquito species whose larvae are predatory on other mosquitos. Notable among these are the larvae of the Psorophora and Toxorhynchites. The use of Psorophora in this regard is very limited, because they are serious biting pests. However, they could possibly be used in some areas to help cut down on a disease vector. Toxorhynchites, on the other hand, have been used extensively for mosquito control in various Pacific Islands. Toxorhynchites are primarily tree-hole breeders, but they also breed in other cavities and artificial containers. This is their only limitation as predators. All Toxorhynchites larvae are predatory. They feed not only on other mosquito larvae and each other but on any other aquatic animals that may be present in the same environment. The appetites of these large larvae are enormous. One has been reported consuming 195 mature larvae of *Aedes aegypti* in approximately 12 days before pupation. The greatest promise for the use of Toxorhynchites for control of mosquito larvae appears to lie in their use against yellow fever and dengue vectors. They can live in the same environments as the vectors of these diseases. The adults of Toxorhynchites can be released in an area infested by disease vectors to seek out their breeding places. In many cases, it is nearly impossible to find all the tree holes and water-catching plants in which these various vectors can breed. Therefore, use of these mosquitos is a comparatively easy control measure.

Bacillus thuringiensis israeliensis is a pathogen (an example of control through disease) which can be released in the environment which will kill mosquito larvae and will not reproduce itself. It has been known to be effective for most mosquito species as well as some species of black flies. It seems to show promising effects fro biological control at most bases.

Malaria and malaria vector control. Control of mosquitos of genus Anopheles, for the purpose of malaria control, differs from control of mosquitos of other genera. Thus, genus Anopheles deserves special attention here. In 1935, it was estimated that there were more than four million cases of malaria in the United States. In 1957, however, only five new cases were reported in the entire country. These figures indicate that malaria can be controlled. They also indicate that malaria is no longer a serious problem in the United States. On a worldwide basis, the situation is considerably different. In 1952, there were an estimated 350 million cases, with three and a half million deaths throughout the world. This figure dropped in 1957 to approximately 300 mil-

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lion cases, with about 2 million deaths. The average is still one death about every 15.6 seconds. Many of these occur in overseas areas where United States military personnel are stationed.

In order for an insect-borne disease such as malaria to be transmitted, three things are required. These are (1) a source of disease (in the case of malaria, this is a human being); (2) a susceptible host (a person who does not have malaria but who could get it); and (3) a suitable insect vector to transmit the infection from the source to the susceptible host. Removal of any of these factors could theoretically stop the spread of malaria. All three factors are considered in malaria control as practiced by the World Health Organization. The Air Force, too, makes every attempt to control all of these factors where possible. However, control of the source is frequently not possible. Therefore, emphasis is placed on vector control and on protection of the susceptible host.

WHO control methods. Control activities carried out by the World Health Organization (WHO) involve mass surveys for detection of malaria cases. Infected people are treated for malaria. In addition, they are, as far as possible, protected by screening and residual spraying. This prevents mosquitos from getting to the infected source and picking up the infection. The next step is directed toward the control of infected insect vectors (i.e., Anopheles spp.).

The best form of overall mosquito control is based on killing the mosquito larvae or on removing their breeding areas. However, for control of malaria, it is considered to be more effective to attack the adult mosquito directly. This idea is based on the fact that adult mosquitos may already have fed on a source and may be able to transmit the disease. Thus, killing the larvae will not reduce the danger of immediate infection. The best known method of killing these adult mosquitos is with residual sprays. This makes it impossible for them to reach an infected source. The system used in the United States during World War II, and presently used in many parts of the world, is based on this type of control. Teams of trained personnel spray all houses in an entire area with a residual insecticide. The Anopheles will usually rest on the wall for a few moments, then feed on a human being, return to the wall to rest again, and then depart. It is during this period of resting, before and after biting, that control is effected. Even if the mosquito does reach the source of infection (i.e., humans), she will usually die before sufficient time has passed for malaria to develop within her body to the extent that she can infect a person. A spray campaign of this type is usually repeated in 6 to 12 months and is maintained for a period of 2½ to 3 years. After this, a survey is carried out to determine if small areas of infection still remain. These are then attacked with the same control measures.

Military control methods. It is not practical under combat conditions for the military to attempt the type of control measures that are carried out by the World Health Organization. However, such measures are definitely needed and should be applied, if possible. For example, villages and towns that have been captured can be given a residual spray treatment to prevent malaria transmission to the troops. In most cases, the best system for the military to follow is based on adult mosquito control, frequently with use of spray aircraft, to kill as many adults as possible in a short time.

Along with such measures, the susceptible hosts (people) are protected from attack by infective mosquitos. This is usually done by the use of suppressive drugs, such as chloroquine, and by the use of repellents and other personal protective measures. In oversea areas during wartime, native dwellings in the vicinity of airbases and other troop concentrations can be treated with residual spray. In peace time, any such activity must be coordinated through local health departments.

Integrated pest management. Integrated pest management (IPM) is the harmonious use of two or more types of control techniques to solve pest problems. IPM implies the decreased reliance upon pesticides as the sole source of control. A good IPM program uses pesticides only when necessary so that environmental impact, likelihood of resistance, and expenses are all minimized. Applying IPM principles to the chemical control of mosquito pests means that the decision to use pesticides is not based upon some fixed prophylactic schedule but upon sound data generated from a good larval and adult surveillance program. The types of control procedures that should be integrated in a sound IPM program for mosquitos include:

a. Source reduction to reduce or eliminate mosquito breeding (cultural control).

b. Protective devices such as repellents, bed nets, and screens to decrease contact with biting mosquitos.

c. Biocontrol agents such as mosquito-eating fish (*Gambusia affinis*) and pathogens (*Bacillus thuringiensis israeliensis*) to reduce immature populations.

d. Larviciding of known breeding areas with an EPA approved insecticide when necessary.

e. Ultra-Low-Volumne (ULV) adulticiding with an EPA approved insecticide when necessary. ULV is accomplished by applying low amounts of pesticide (e.g., 1 to 2 ounces per acre of land) to kill the adult mosquito without adversely affecting other insect populations. ULV application is ecologically sounder and provides two modes of killing the adult mosquitos (by inhalation due to the small particle size of the pesticide as well as body contact with the pesticide). In addition, this type of application has a longer killing action than the other forms of adulticiding because the pesticide stays airborne longer. Ground applied ULV is the most common method. Aerial ULV adulticiding is used when all else fails to control mosquitos or when there is an imminent threat of mosquito-borne disease. Aerial ULV requires specialized aircraft not usually available on all bases.

Exercises (068):

1. What two ways do larvicides work?

2. State two ways chemical control of adult mosquitos may be done.

3. Name some predators which may be used for biological control of a mosquito population.

4. The Malaria Vector Control Program's mission is to control which mosquito genus?

5. What is Integrated Pest Management (IPM)?

7-4. Other Arthropods

Other arthropods may also be involved in the transmission of diseases. Some of the primary ones are lice, flies, fleas, ticks, mites, and venomous arthropods.

069. State the diseases transmitted and control methods used for other medically important arthropods.

Lice. Human lice are found all over the world. They thrive during famines, wars, and among people suffering economic hardships. Whenever large groups of people are deprived of homes, clothing, and bathing facilities, lice usually appear. They are particularly associated with cold weather. Although lice are present in the higher altitudes of the tropics, they are found more commonly in temperate and subarctic areas where people wear heavy clothing in several layers. Diseases transmitted by lice have always been a threat to fighting forces. Wars have been lost as a result of the casualties caused by a louse-borne disease.

Louse-Borne diseases. The louse-borne diseases are typhus fever (epidemic), relapsing fever, and trench fever. Of these, epidemic typhus is the most important. Trench fever was very common among European armies during World War I but has greatly declined in incidence since them. Relapsing fever is usually present wherever epidemic typhus occurs; cases occurred among American troops both in World War II and in Korea. All of these diseases, which are spread from human to human by lice, may occur in epidemics. Since they are serious infections, they are a special threat to armies. A good vaccine against typhus fever is available, but as yet none is available for relapsing fever or trench fever. The condition of pediculosis refers to a lice infestation on the body. Recurring lice infestations may be a problem in child care centers, and staff members should screen children for them.

Method of disease transmission. Disease is seldom transmitted by the actual bite of the louse. The germs contained in the gut of the louse are passed out with the droppings of the louse when it feeds. Louse bites itch and cause scratching, during which the germ-laden feces are rubbed into the tiny skin brasions. Scratching also may crush the louse and rub the germs it contains onto the wound. This is true especially in the case of relapsing fever.

Control. The best control for lice is personal cleanliness. As long as frequent baths are taken and clothes are changed regularly, lousiness can usually be kept under control. When bathing is very infrequent and where clothing is worn for long periods of time without changing, particularly if large numbers of people are crowded together in small places, lousiness will be present. The application of steam to clothing for a period of about 5 minutes will kill all the lice and their eggs. Such steam sterilization can be carried out with hospital equipment. Another method is the old "Serbian barrel" method. In this, a drum is put over a fire, a small amount of water is laced in the bottom of the drum, and a rack to hold clothing is placed above the water level. With a good tight top, steam produced in the drum will effectively sterilize the clothing. With respect to crab lice, personal cleaniliness if of paramount importance. In routine situations washing the clothing with very hot water (greater than 140° F.) and dry cleaning clothing that cannot be washed should be recommended.

Chemical sterilization of clothing involves the use of a gas, methyl bromide. Individual clothing and equipment are placed in a rubberized bag and a glass ampule of methyl bromide is placed in a pocket on the inside of the bag. The bag is then sealed. The ampule is broken from the outside, releasing gas. A 45-minute period is required for sterilization by this method. The control method in general use today involves the utilization of an insecticide body dusting powder. This is applied to the hairy parts of the body and in the case of head or body lice, is applied to the seams of the clothing or the headgear. Treatment should be repeated in 7 days to kill newly hatched lice.

In many parts of the world, particularly in the Far East areas such as Korea, resistance to DDT has been noted. In such cases, 1 percent lindane has been used. Lindane, however, is more likely to produce some itching and more skin irritation than DDT. One percent malathion is now being used effectively for personnel dusting. Crab lice can be controlled by the use of insecticidal ointments and creams available at the base hospital. Treatment might have to be reported, depending on what product is used.

Flies. Houseflies are found all over the world, but they are most abundant in warm climates. Houseflies, which comprise the majority of all flies found around food facilities, are the most important of the nonbiting species in the transmission of diseases.

Fly-borne diseases. The medical history of past wars indicates that the health of troops has been seriously affected by flies. They carry the germs which cause dysentery and may carry those which cause cholera, typhoid, and other enteric diseases. In the tropics various skin and eye diseases may be spread by flies.

Method of disease transmission. Flies transmit dis-

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ease organism on the tiny hairs of their bodies and feet and in their feces and vomitus. They may bring the disease germs directly from manure, garbage, and human feces to food and water. Biting flies biologically transmit (through blood sucking) such diseases as onchocerciasis, leishmaniasis, and trypanosomiasis.

Control. Flies may be controlled through proper sanitation, thus eliminating their breeding places; by the screening of living quarters; and by the use of chemicals to kill both adults and larvae. The elimination of breeding through proper sanitation is the most effective fly control measure.

Control of breeding places. Elimination of breeding places of flies requires that all human waste, animal manure, and garbage be covered, disposed of, or treated promptly and effectively. The control of biting flies is based on controlling their living and breeding places (i.e., vegetation removal, insecticide treatment of cracks and crevices in walls, treatment of soil). Controlling biting flies is a very difficult problem.

Protection of food against infestation. All foodhandling places should be properly screened to protect food against infestation by flies. The screens should be constructed of 24-mesh wire to bar mosquitos as well as the flies. Foodhandling places should also be equipped with self-closing doors which fit snugly and open outward.

Chemical control. While the use of chemicals is an important aid to fly control, it should never be adopted as a substitute for sanitation. In places where sanitation is difficult, chemicals may be used to control fly breeding or to prevent new adults from leaving their breeding places.

Fleas. Fleas are medically important because they produce irritating bites and transmit diseases to humans. The fleas that attack humans live chiefly on cats, dogs, and rodents. When humans live and work in close association with these animals, conditions are ideal for the occurrence of flea-borne diseases. Although fleas have certain host preferences, they will transfer to and feed on different animals, including humans.

Flea-borne diseases. Fleas are responsible for the transmission of plague and endemic typhus (murine typhus). Various rodents, principally rats and ground squirrels, are sources of infection from which fleas pick up the disease germs and transmit them to humans. When the normal rodent hosts are unavailable, rodent fleas will readily attack humans. Other fleas (chigoe or jigger fleas) attack the bare feet, usually between the toes and on the soles of the feet, where they cause painful swelling and inflammation.

Methods of disease transmission. Fleas become infected with plague germs when they feed on a rodent that has plague. Plague is then transmitted to humans through the bite of the infected flea. Humans can also become infected with plague when they breath the plague germs coughed out of the lungs of a person who has pneumonic plague. Typhus fever (murine) is transmitted when flea feces or crushed fleas are scratched into the skin. This may happen when a person scratches a flea bite.

Control. Fleas are controlled by applying insecticides to the animal hosts and to the infested areas. Insecticide powder is applied to animals. Powder or liquid insecticide may be applied to the infected area; however powder is preferred for treating rodent burrows, since it can be distributed more thoroughly than a spray.

Dusting of animal hosts. An insecticide powder is ordinarily used to control fleas on animals. Animals that lick themselves should be dusted with pyrethrum powder. However, merely dusting the animals, will not control the fleas, since flea eggs and larvae are in the debris about the areas where the animals rest. Unless these areas are properly treated, reinfestation will take place.

Treatment of infested areas. In the treatment of areas infested with fleas and flea larvae, such as rodent nests, burrows, and runways and places where other animals rest, an insecticide dust is effective. It can be applied with the hand duster. Should a plague epidemic occur, the dusting operations to kill the fleas must always be accomplished before the rodent poisoning operations are started; otherwise, the fleas will feed on human beings.

When rodents or other flea-infested animals enter buildings, the fleas may leave the host and infest the cracks and crevices in the floors. These fleas may deposit eggs which hatch into larvae which continue to live and develop in the cracks and crevices of the floor. Good cleaning practices will do much to eliminate or prevent such infestations. If necessary, an insecticide dust or spray should be applied.

Individual protective measures. Individual protective measures should be used in flea-infested areas. This is especially important for those persons who perform flea and rodent control work where plague and endemic typhus are present. Clothing, particularly the trouser legs, should be impregnated with insect repellent. If insect repellent is not available, an insecticide dust should be applied to the boots, socks, and lower parts of the trouser legs. Insect repellent Di-Ethyl Toluamide (DEET) should also be applied to the hands and other exposed portions of the body. The sleeves should be kept rolled down, and the trouser legs should be kept tucked into the boots.

Ticks. Ticks occur throughout the world but are less common in the arctic and subarctic zones. They are divided into two groups: the hard ticks and the soft ticks. The hard tick has a hard shield on its back, and its mouthparts can be seen from above. The soft tick does not have a hard shield on its back, and its mouthparts cannot be seen from above; it often has a leather-like appearance.

Tick-borne diseases. Hard ticks are known to carry and transmit several diseases such as Rocky Mountain spotted fever and other typhus-like fevers, tularemia (rabbit fever), Q fever, and certain viral diseases. Some kinds of hard ticks can cause tick paralysis. This condition results after a female hard tick has remained attached to the base of a person's neck or the back of his head for several days. This is most likely to occur when the tick attaches near the hairline or in the hair, thus making detection of it difficult. When tick bites are numerous, the skin may become badly inflamed and infected. Several species of soft ticks transmit relapsing fever.

Method of disease transmission. The tick becomes infected with the disease organism when it feeds on an infected animal. It can then transmit this disease to humans if it feeds on them later. Both the hard and the soft ticks can also pass the germs of several disease to their offspring through their eggs, so that future generations of ticks are already infected when they hatch from the eggs.

Control. Tick control is accomplished three ways: environmental control; individual protective measures; and removal of ticks.

Environmental control. Controlling vast areas of tick-infested land is a major operation. A certain degree of control can be accomplished by clearing away brush and vegetation and keeping the ticks out by spraying or dusting with insecticides on walls and in cracks and corners. Insecticides may also be used to spray or dust the vegetation and the ground in tick-infested areas. Effective control of ticks is greatly dependent upon knowledge of the species present.

Individual protective measures. Impregnating clothing with an insecticide clothing repellent (such as resmethrin) gives excellent protection against ticks. Insect repellent (DEET) applied to the exposed skin provides additional protection. Proper wearing of the uniform will also reduce tick bites. The bottoms of trousers should be tucked inside the boots without blousing rubbers. Shirts should have the sleeves rolled down, be fastened at the waist, and buttoned at the neck. Blousing rubbers make it possible for ticks as well as mites to slip between the top of the boots and the treated cloth unharmed. Additionally, the pants and shirt should be tight fitting at the waist.

Removal of ticks. It may require some time for ticks to infect a person after they attach to his body. Persons in tick-infested areas should examine themselves and each other at least every 2 hours for the presence of ticks and remove any ticks. This will often prevent the transmission of disease. In the removal of an imbeded tick, care must be taken not to crush it or to leave its mouthparts imbedded in the skin. A tick can be removed most effectively by using small forceps to grasp and then carefully pulling it off. The tick should not be grasped by its abdomen, since disease germs may be injected into the person due to pressure in this area. After a tick is removed, it should be killed with alcohol or heat; then the bite should be treated with a suitable antiseptic.

Mites. Mites are found throughout most of the world in paractically all climates. Many mites feed on plants but some feed on humans and animals. Mites lay eggs which hatch into six-legged larval mites. Certain mites feed on humans and animals only in this larval stage; these are commonly called chiggers. Larval mites develop into nymphs; and these, in turn, develop into adult mites. Both the nymphs and adults have eight legs.

Mite-borne diseases/conditions. The scabies itch mite burrows and lives in the skin of man, causing a condition called scabies or the 7 year itch. This condition is not fatal but may cause much discomfort due to intense itching, especially at night. Scabies is often found among people who do not or cannot practice good personal hygiene. Additionally, hospital personnel may become infested due to assisting in the treatment of infested patients. Scabies mites are transferred from person to person by personal contact. The use or wearing of infested clothes, bedding, or towels may also be a method of transmission. Bites from chigger mites and some rodent mites may also cause severe itching. Infection may result from scratching these bites. In Southeast Asia some kinds of chiggers transmit a dangerous disease called scrub typhus or Tsutsugamushi disease. Chiggers often occur in tall grass or in scrub vegetation, appearing after land has been cleared and abandoned. When people enter these mite-infested areas, they may be attacked by chiggers. Certain rodent mites are involved in the transmission of rickettsial pox—a rare, nonfatal disease occurring primarily in large cities in the United States and Russia. Korean hemorrhagic fever may also be transmitted to humans by biting mites.

Mite control. Scabies itch mites are killed by applying a insecticidal ointment to affected parts of the skin. Washing the skin thoroughly with soap and water before applying the ointment will aid in its effectiveness. This should be applied as directed until all the mites are killed. Disinfection of clothing and bedding with methyl bromide or heat destroys scabies itch mites. Laundering in hot water and dry cleaning are likewise effective.

Area control of larval mites (chiggers) is often difficult or impractical. However, in permanent or semi-permanent camps located in scrub typhus areas, it is desirable to remove all surrounding growth with bulldozers, to burn the collected debris, and to place tents 2 or 3 feet off the ground. Application of insecticide to the ground in the camp area and in training areas will aid in mite control. Insecticides are effective. Control of rodents is also helpful in reducing the number of chiggers.

Mite-infested areas should, if possible, be avoided. If mite-infested areas cannot be avoided, personnel should apply the same individual protective measures that we discussed for ticks.

Venomous Arthropods. Air Force personnel stationed in the United States face a greater risk of contacting a venomous arthropod than the average United States resident because: (1) a large portion of bases are located in the southern half of the United States where venomous arthopods are most numerous; (2) many facilities (such as radar, communications, security, and missile sites) are located in remote areas where venomous arthropods are not controlled; (3) numerous Air Force training and work activities must be performed outside; and (4) many military structures (such as older wooden buildings, storage buildings, and field training facilities) provide excellent habitats for venomous arthropods. It is important, therefore, that your medical facility has current information available concerning the most important venomous arthropods in your area.

Medical importance. Although most people are aware of the pain and discomfort associated with contacting a venomous arthropod, many are not aware that these arthropods (such as ants, bees, wasps, spiders, and scorpions) are responsible for more human deaths in the United States each year than any other group of venomous animals, including snakes. Additionally, some venomous arthropods are directly involved in disease transmission (i.e., kissing bug - Chagas disease).

Control avoidance. To assist in preventing envenomization accidents, there are several means of avoidance. When insecticides are necessary, an Air Force, County Extension Service, or United States Department of Agriculture entomologist should be consulted for current recommendations. Any insecticide must be applied according to the instructions on the container label. Recommendations for control of specific venomous arthropods and the treatment of envenomization accidents can be found in AFP 161–43, *Venomous Arthropod Handbook*.

Exercises (069):

1. Match the primary disease vector in column B with the disease it causes in column A. Choices in column B may be used once, more than once, or not at all (only one answer per question).

Column A	*Column B*
___ (1) Rocky Mountain spotted fever.	a. Body louse.
___ (2) Bubonic plague.	b. Flea.
___ (3) Murine typhus.	c. Tick.
___ (4) Enteric Diseases.	d. Fly.
___ (5) Tularemia.	e. Mite.
___ (6) Epidemic typhus.	
___ (7) Rickettsial pox.	
___ (8) Scabies.	

2. Cite two ways fleas are controlled.

3. What is the best control measure for lice?

4. How are flys controlled?

5. How is the scabies mite transferred from one person to another?

6. Name a standard insecticide personal repellent effective of most arthropods.

7. What is the best means of preventing envenomization accidents?

7-5. Rodents

Rodents are nocturnal. Ordinarily, they do not move about during the day, since they prefer the cover of darkness to forage for food and water. They move in narrow runs along buildings, walls, pipes, and overhead beams. Rodents gnaw through materials to obtain food and harborage. Wood is not a barrier, since they have very sharp teeth which cut through it quickly. They are spoilers. For example, they will take one bite from many potatoes instead of eating one, sample every bag of flour, and eat from every piece of meat, thus contaminating all of them. These pests damage far more food than they eat.

070. State the disease transmitted and control methods used for rodents.

Rodent-borne diseases. Rodents are carriers of several human diseases. Most of these diseases are transmitted through an insect vector, but with a few exceptions they can also be transmitted by direct contact.

Plague. Plague ranks first in importance among rodent-borne diseases. It is found worldwide. Primarily a disease of rats and or other wild rodents, plague may be transmitted to humans by the bite of a flea which has previously fed on an infected rodent. Control of plague is accomplished through the control of rodent fleas with the use of various insecticides.

Endemic typhus. Endemic or murine typhus is transmitted to humans by the feces of rat fleas. It is occasionally seen in the southern and southeastern parts of the United States but is also found in many other parts of the world. This disease is usually milder than the epidemic typhus transmitted from human to human by the body louse.

Leptospirosis. Leptospirosis is caused by contact with urine or the feces of an infected rat or other animal. It is widely distributed throughout the world and may be contracted through the skin or mucous membrane by coming in contact with water contaminated with infected urine or feces or by the consumption of food which has been contaminated by rats. Hogs, dogs, and cattle also have been known to spread the germs which cause this disease.

Rocky Mountain spotted fever. Rodents and other animals are the natural reservoirs of this disease. It is transmitted to humans by infected ticks.

Scrub typhus. Also called tsutsugarmushi fever or Japanese river fever, this disease is transmitted by a larval mite which is normally parasitic on rodents.

Tularemia. This is a serious disease which may be contracted from the handling of infected rabbits or rodents or from the bite of ticks or deer flies. It is widely distributed throughout the United States and has also been reported in Russia, Japan, Central Europe, Scandinavia, and Canada.

Salmonellosis. Although the major sources of Salmonella are foodhandlers and poultry products, the germs may come from infected rats and mice. The germs may be transmitted by food which has been contaminted with rat feces and urine.

Trichinosis. This is a disease of rats and pigs. Humans become infected through the consumption of infected pork which has not been cooked sufficiently. Pigs contract the disease by eating infected pork scraps in garbage and sometimes by eating infected rodent carcasses.

Rat-bite fever. The germs which cause this disease are transmitted through the bite of a rodent. This disease is uncommon in the North and South Americas and in most European countries but occurs somewhat frequently in other parts of the world.

Control. The best control for rodents, as well as insects, is prevention by maintaining adequate environmental sanitation. Physical preventive measures and sanitation practices are of foremost importance. Prevention of entry into buildings, frequent and thorough cleanup of trash and debris, proper waste disposal, proper food storage, and elimination of sources of food and harborage are all preventive measures in rodent control. For control of existing populations, in addition to physical measures, chemical eradication programs are used.

Physical or structural controls. One of the fundamental physical control methods for preventing rodent infestations in buildings is ratproofing. Ratproofing should be included in the plans for all new construction. On existing structures, this consists of changing structural details to prevent entry of rodents into buildings. Openings as small as ½ inch will admit mice and young rats.

Mechanical control. Mechanical control, which is achieved through the use of traps, is the method of choice in any area where food is handled or stored because of the hazards created in using a poisonous chemical around food. A large number of traps should be used, since a 10-percent catch is considered good. Various types of mechanical traps are available. The type used most frequently is the snap trap which kills the rodent.

Chemical control. Chemical control, which is achieved through the use of poisonous bait stations, may be the method of choice except in the areas where food is handled or stored. If applying poisonous bait in food areas becomes necessary, the work should be performed by personnel who have had specialized training.

Anticoagulants are the rodenticides generally recommended. They are usually available and are the ones with which the untrained individual is least likely to experience difficulties. Some anticoagulant poisons, such as warfarin, pival, or fumarin, kill in a radically different manner from single-dose poisons. They must be ingested fro several days before they become effective. This provides a definite safety factor for children or animals eating a single portion of anticoagulant bait.

Shipment of specimens. The most important requisite for preparation and shipment is that the specimens arrive at the laboratory in a condition that will permit proper identification; that is, with identification characteristics as complete and undamaged as possible. You should be very careful when you prepare specimens for shipment to prevent breakage of specimen slides or bottles containing preservatives. In the tropics, you should take particular care to store insects in dry containers. This will prevent mold. You can quick-freeze or use dry ice to lengthen the time specimens can be in transit.

If you wish to ship only the rodent ectoparasites, kill, wash (be sure to filter the wash water), and comb the rodent to remove the ectoparasites. Prepare the ectoparasites for shipment by placing them in a vial (or procaine tube) containing 70 percent alcohol. As the rubber stopper is pushed into the neck of the tube a bubble of air is usually trapped. Since this bubble will damage specimens as it passes over them during shipment it must be removed. Insert a hypodermic needle into the stopper to allow the trapped air to escape. Remember neither combing nor washing removes sticktight fleas or ticks. These must be picked off with forceps. To collect ectoparasites for shipment for identification you must check rodent traps each morning, because if the rodents die, the ectoparasites will not remain on the dead rodents.

Properly tag or label all specimens to be shipped. Include all information concerning locality, date, and elevation at which the collection was made. The collector's name and other pertinent information, such as habits, habitat, abundance, and distribution of the specimens, should also be included.

If there are any questions concerning shipment of any specimens for identification, contact the Epidemiology Division, USAFSAM/EKED, (Autovon 240-3471), Brooks, AFB, TX 78235.

Exercises (070):

1. List some rodent-borne diseases.

2. What is the best method of control for rodents?

3. Which type of rodenticides are safer and why?

4. What is the most important thing to remember when shipping specimens to the lab for identification?

5. How are ectoparasites to be shipped to the lab for identification?

6. If you have questions concerning shipment of any specimens for identification, whom should you contact?

7-6. Rabies Control Program

Rabies is a disease found worldwide. You will be actively involved in its prevention and control. For you to understand how important this control program is, we need to begin with a discussion of the disease. We will stress the causative agent, symptoms, and methods of transmission in our discussion.

071. Identify the causative agent, symptoms, and methods of transmission of rabies.

Rabies. Rabies is a widespread viral disease which affects any warm blooded animal. It is almost always fatal in affected animals (and humans). The virus affects the central nervous system (spinal cord and brain) resulting in a fatal encephalitis (inflammation of the brain).

The incubation period (time from exposure until disease symptoms appear) is variable in different species of animals. It also may be quite variable from animal to animal within the same species. In the dog the incubation period usually lasts 15 to 25 days but may exceed as long as 120 days or so (this is why most rabies-free countries insist on a 180 day quarantine period for incoming dogs).

The clinical signs of rabies infection in animals may also be quite variable, depending on the stage of disease. The disease is usually transmitted by the saliva of infected animals. Usually a break in the skin (cut, scratch) is necessary for infection to occur. Thus rabies is usually associated with the bite of an infected animal. Saliva of infected dogs and cats may contain the virus for several days before they appear clinically ill. This is why domestic animals involved in biting incidents are held in quarantine for 10 days; if the virus was in the saliva at the time of the bite, then the animal will appear ill within 10 days. Then the bitten person can begin antirabies immunization. If the dog or cat remains healthy for 10 days, then the patient need not receive antirabies immunizations. If the biting dog is not found and observed for 10 days, then the bitten person often begins receiving antirabies immunizations. If the biting dog is not found and observed for 10 days, then the bitten person often begins receiving antirabies immunizations immediately. These immunizations (artificial active immunity) are a necessary precautionary measure since the disease is so severe. An important point to remember: the treatment has to be given before the person starts showing signs of encephalities. After that, the immunizations won't work.

Rabies virus may also be transmitted by aerosol in unusual circumstances. A few human cases have occurred after exploring infected bat caves. Infection may also occur following ingestion of infected animals. Neither of these routes is very likely for humans. Rabies has been transmitted by corneal transplantation from one human to another.

Various wild species serve as reservoirs of rabies infection in the United States. Skunks are important reservoirs in the Mississippi River Valley; foxes are important along the eastern seaboard; raccoons in Florida, Virginia and Georgia; and bats in various locales containing bat caves. In most foreign countries dog rabies is the main problem due to large stray dog populations which maintain the infection.

Rabies may be diagnosed at various laboratories using brain tissue from suspect animals. This is why needs of suspect animals are shipped to the laboratory for testing.

There is no treatment for infected animals (including people once the signs of encephalitis begin). In fact, the *usual recommendation is euthanasia for any exposed* pet, vaccinated or not. The disease is just too serious to take any chances. Pets are vaccinated primarily to prevent them from transmitting the disease to humans, not just for their own protection.

Exercises (071):

1. Rabies affects which physiological system?

2. How long is the incubation period for rabies in the dog?

3. Of the following methods of transmission of disease place a 1 before the common methods of transmission of rabies, a 2 before methods also possible, and a 0 before methods not presently reported.

____ a. By saliva on intact (not scratched or broken) skin.
____ b. By saliva introduced from biting.
____ c. By inhalation of aerosolized rabies virus in a confined area.
____ d. By saliva introduced into a scratch.

072. Explain the administration of the Rabies Control Program and Environmental Health Service's responsibilities.

Purpose and Importance of Control. It is obvious from the previous discussion of rabies that the disease is very serious. It is also a complicated problem for medical personnel. Only a handful of people have ever survived rabies once they developed the clinical signs of encephalitis, and treatment helps very little once the signs begin. This fact alone makes it extremely important that all people who are bitten by an animal receive a medical evaluation to determine if they have been exposed to rabies. If someone has been exposed to rabies, the success of antirabies immunizations is directly related to how soon after the exposure (a bite for example) the immunizations are started. In other words, the longer a person waits to get treated after being bitten by a rabid animal, the greater his or her change of dying even though treated.

On the other hand, no one should receive any kind of medical treatment unless it is necessary. Antirabies immunizations, like all medication, can cause medical problems. They can be painful, and there is a slight chance that someone may have a severe reaction to the antirabies vaccines.

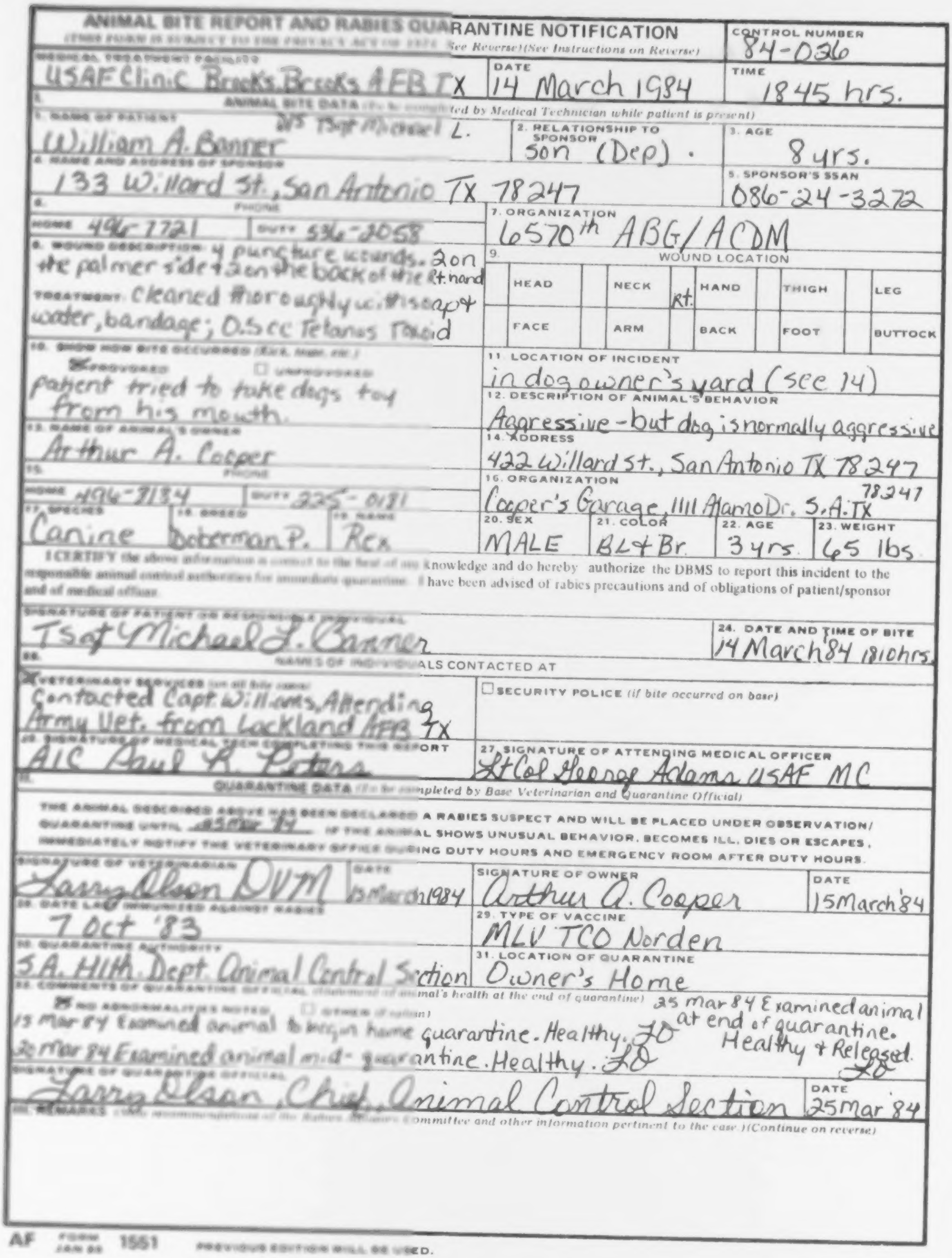
The human diploid cell rabies vaccine (HDCV) has been licensed for use as an antirabies immunization since 1980. Prior to this time the duck embryo vaccine (DEV) was used, which produced such adverse reactions as severe muscle aching, generalized body soreness, hiveness, etc., on a routine occurrence (as any vaccine of a foreign protein would produce). In some cases even death secondary to the reactions occurred. The human diploid cell vaccine has had fewer side effects reported and appears to be a very effective vaccine. During a 2 year period, 108 clinical reports of systemic allergic reactions ranging from hives to anaphylaxis were reported to CDC (11 per 10,000 vaccinees), and no deaths as a result of the vaccine were reported. For these reasons HDCV is used by the Air Force as an antirabies immunization.

The problem is like a double-edges sword. If someone is bitten, the doctor who attends the victim has to decide if the patient needs antirabies treatment. If the patient has been exposed to rabies and the doctor doesn't give antirabies treatment, the patient may die. If, on the other hand, the patient has not been exposed to rabies and the doctor gives antirabies treatment, the patient may experience an unnecessary reaction.

The attending physician must make a decision whether to give a patient antirabies immunizations or not. How does he or she make that decision? Here is where the medical problem becomes complicated. You will recall that the way animals—including humans—get rabies, is by being exposed to a rabid animal (most often by being bitten). Therefore, in order for a doctor to decide if a patient needs antirabies immunizations or not, he or she must know if the animal that bit the patient was rabid. As mentioned previously, the only way to know if an animal is rabid or not is by examining its brain in a laboratory. This requires that the animal be killed and that its head be removed and sent to a laboratory. If the brain tissue is positive for rabies the patient should receive antirabies immunizations. If the brain tissue is negative for rabies, there is no need to give the patient antirabies immunizations. Obviously, the doctor who sees a patient who has been bitten by an animal can't make the decision to provide antirabies immunizations just by examining the patient's wound and asking questions. The doctor has to rely on the assistance of other medical and nonmedical personnel such as the EHS, Security Police, an assigned or attending veterinarian (Army), the local civilian Public Health Department, and the local civilian animal control officials. In order to decide whether a particular patient should receive antirabies immunizations or not, he or she needs to know certain information: where the animal is; is it alive or dead; if alive, can the animal be killed and its head sent to a laboratory; how long will it take to get the results back from the laboratory; whether the animal is a dog or cat, where is it and can it be quarantined for 10 days; is the dog or cat healthy; who will quarantine the dog or cat and let the doctor know if the animal becomes ill during the quarantine? These and a host of other questions need to be answered so that the doctor can provide the patient with proper treatment. And, the doctor needs to know the answers as soon as possible so that if antirabies immunizations are needed, it can be started immediately. Remember, the longer the period of time a patient has to wait (for whatever reason) after being exposed to rabies, until he or she starts antirabies immunizations, the greater the chances are that the treatment won't help and the patient will get rabies. The doctor is actually deciding how to treat the bite patient based on information provided to him or her by all or some of those other medical and nonmedical personnel.

Animal Bite Control Program. AF Form 1551, Animal Bite Report and Rabies Quarantine Notification, (fig. 7-13) is used to transmit the information from office to office and person to person, but telephone calls may be used first, especially when time is critical. The best way to see how AF Form 1551 should be handled is to follow a typical bite case starting when the person is bitten and goes to the emergency room. By looking at the diagram in figure 7-14 (refer also to the diagram notes) you can get some idea of how AF Form 1551 moves around and how the information is reported and recorded. The most important thing to remember is that each office or person that gets involved must immediately take some actions to see that their part is done or send the information back, stating why they can't accomplish their part of the program. These are the kind of actions that just cannot wait. As the monitor for the administration of the program, the EHS acts as a "tracker" of information.

You can see that taking care of an animal bite patient becomes a very serious and complicated problem. Because so many people may be involved in caring for a bite patient; because not all the information needed to decide how the patient should be treated is available when the patient first comes to the hospital; and because that information needs to get to the doctor as soon as it becomes available; the Air Force has set up a separate Animal Bite Control Program. The EHS is responsible for monitoring the administrative aspects of the program. What this means is the EHS personnel are responsible for seeing that information about each animal bite case gets to each office or person who must take part in the program and that important information that will help the doctor decide how to treat the patient is reported to the doctor immediately. The only real danger arises when no information is returned to the attending physician. The physician can decide what to do if he or she knows that the animal is available for laboratory analysis or quarantine. The physician can also decide what to do if he or she has been advised by the quarantine offices that the animal can't be found. But, if no one advises the physician about the animal, he or she can't decide how to care for the patient. The person bitten needs to begin antirabies immunizations as soon as possible after the bite because there is no specific treatment when someone becomes sick with rabies and because rabies is literally 100 percent fatal.



ANIMAL BITE REPORT AND RABIES QUARANTINE NOTIFICATION
(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - See Reverse)(See Instructions on Reverse)

CONTROL NUMBER 84-026

MEDICAL TREATMENT FACILITY USAF Clinic Brooks, Brooks AFB TX
DATE 14 March 1984
TIME 1845 hrs.

ANIMAL BITE DATA (To be completed by Medical Technician while patient is present)

1. NAME OF PATIENT William A. Banner s/o TSgt Michael L.
2. RELATIONSHIP TO SPONSOR son (Dep).
3. AGE 8 yrs.
4. NAME AND ADDRESS OF SPONSOR 133 Willard St., San Antonio TX 78247
5. SPONSOR'S SSAN 086-24-3272
6. PHONE HOME 496-7721 DUTY 536-2058
7. ORGANIZATION 6570th ABG/ACDM
8. WOUND DESCRIPTION 4 puncture wounds. 2 on the palmer side + 2 on the back of the Rt. hand
TREATMENT Cleaned thoroughly with soap + water, bandage; 0.5cc Tetanus Toxoid

9. WOUND LOCATION

	HEAD		NECK	Rt.	HAND		THIGH		LEG
	FACE		ARM		BACK		FOOT		BUTTOCK

10. SHOW HOW BITE OCCURRED (Kick, tease, etc.)
☒ PROVOKED ☐ UNPROVOKED
patient tried to take dogs toy from his mouth.

11. LOCATION OF INCIDENT in dog owner's yard (see 14)
12. DESCRIPTION OF ANIMAL'S BEHAVIOR Aggressive - but dog is normally aggressive
13. NAME OF ANIMAL'S OWNER Arthur A. Cooper
14. ADDRESS 422 Willard St., San Antonio TX 78247
15. PHONE HOME 496-7134 DUTY 225-0181
16. ORGANIZATION Cooper's Garage, 1111 Alamo Dr. S.A. TX 78247

17. SPECIES	18. BREED	19. NAME	20. SEX	21. COLOR	22. AGE	23. WEIGHT
Canine	Doberman P.	Rex	MALE	BL + Br.	3 yrs.	65 lbs.

I CERTIFY the above information is correct to the best of my knowledge and do hereby authorize the DBMS to report this incident to the responsible animal control authorities for immediate quarantine. I have been advised of rabies precautions and of obligations of patient/sponsor and of medical officer.

SIGNATURE OF PATIENT OR RESPONSIBLE INDIVIDUAL TSgt Michael L. Banner
24. DATE AND TIME OF BITE 14 March 84 1810 hrs.

NAMES OF INDIVIDUALS CONTACTED AT

☒ VETERINARY SERVICES (on all bite cases) Contacted Capt. Williams, Attending Army Vet. from Lackland AFB TX
☐ SECURITY POLICE (if bite occurred on base)

26. SIGNATURE OF MEDICAL TECH COMPLETING THIS REPORT A1C Paul R. Peters
27. SIGNATURE OF ATTENDING MEDICAL OFFICER LtCol George Adams USAF MC

QUARANTINE DATA (To be completed by Base Veterinarian and Quarantine Official)

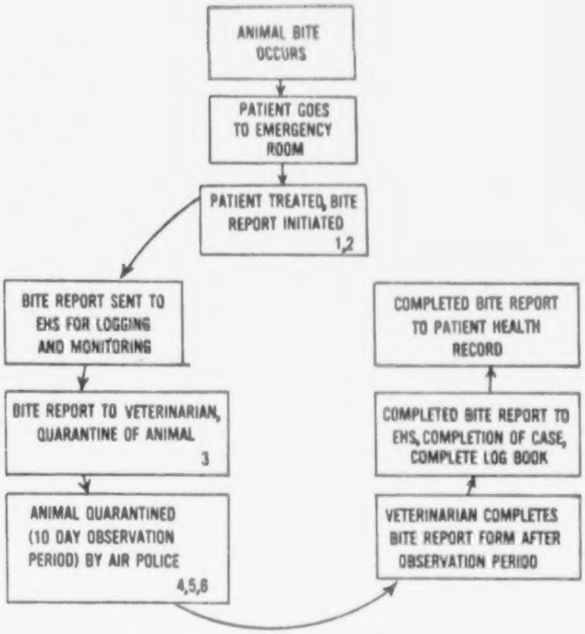
THE ANIMAL DESCRIBED ABOVE HAS BEEN DECLARED A RABIES SUSPECT AND WILL BE PLACED UNDER OBSERVATION/QUARANTINE UNTIL 25 Mar 84. IF THE ANIMAL SHOWS UNUSUAL BEHAVIOR, BECOMES ILL, DIES OR ESCAPES, IMMEDIATELY NOTIFY THE VETERINARY OFFICE DURING DUTY HOURS AND EMERGENCY ROOM AFTER DUTY HOURS.

SIGNATURE OF VETERINARIAN Larry Olson DVM DATE 15 March 1984
SIGNATURE OF OWNER Arthur A. Cooper DATE 15 March '84
28. DATE LAST IMMUNIZED AGAINST RABIES 7 Oct '83
29. TYPE OF VACCINE MLV TCO Norden
30. QUARANTINE AUTHORITY S.A. Hlth. Dept. Animal Control Section
31. LOCATION OF QUARANTINE Owner's Home
32. COMMENTS OF QUARANTINE OFFICIAL (Statement of animal's health at the end of quarantine)
☒ NO ABNORMALITIES NOTED ☐ OTHER (Explain)
15 Mar 84 Examined animal to begin home quarantine. Healthy. LO
20 Mar 84 Examined animal mid-quarantine. Healthy. LO
25 Mar 84 Examined animal at end of quarantine. Healthy + Released. LO
SIGNATURE OF QUARANTINE OFFICIAL Larry Olson, Chief, Animal Control Section
DATE 25 Mar '84

REMARKS (Give recommendations of the Rabies Advisory Committee and other information pertinent to the case.)(Continue on reverse)

AF FORM JAN 85 1551 PREVIOUS EDITION WILL BE USED.

Figure 7-13. Example of completed AF Form 1551.


ANIMAL BITE OCCURS
PATIENT GOES TO EMERGENCY ROOM
PATIENT TREATED, BITE REPORT INITIATED 1,2
BITE REPORT SENT TO EHS FOR LOGGING AND MONITORING
BITE REPORT TO VETERINARIAN, QUARANTINE OF ANIMAL 3
ANIMAL QUARANTINED (10 DAY OBSERVATION PERIOD) BY AIR POLICE 4,5,6
VETERINARIAN COMPLETES BITE REPORT FORM AFTER OBSERVATION PERIOD
COMPLETED BITE REPORT TO EHS, COMPLETION OF CASE, COMPLETE LOG BOOK
COMPLETED BITE REPORT TO PATIENT HEALTH RECORD

1. Treating physician calls veterinarian immediately if MD feels it is emergency.

2. Rabies Advisory Board can be called into session if deemed necessary by Physician and Veterinarian.

3. Sent means to give to army Veterinarian when he comes to AFB if on attending basis. If so, FONECON may be necessary to have animal quarantined.

4. Veterinarian contacts local authorities if animal is not an on-base animal and determines status of animal after 10 days.

5. Veterinarian keeps EHO informed about condition of animal's health throughout quarantine period to alert Rabies Advisory Board if necessary.

6. It is a veterinary service responsibility to observe the animal during quarantine or to arrange for quarantine. In some remote areas where attending veterinary service comes from a distant location and the reliability of local public health officials is questionable (i.e. Turkey), these arrangements may include observation by a 908X0.

* Rabies Advisory Board

1) Flight Surgeon, Pres.
2) Treating Physician
3) EHO-Recorder
4) Physician
5) Veterinarian

Figure 7-14. Management of AF Form 1551, Animal Bite Report.

BEST COPY AVAILABLE

Timely communications are very important and complete, accurate records—especially AF Form 1551—are also important.

AF Form 1551 becomes a permanent part of the patient's record when the case is complete. It is initiated in the emergency room and signed by the physician in an original and three copies. As soon as the doctor signs the form and section I is completed, the fourth copy is placed in the patient's record. This copy acts as a suspense file that tells anyone reading the record that the case has not been completed. When the original and remaining copies of the form have been completed (after the domestic animal [dog, cat, etc.] has been examined by the quarantine official at the end of the quarantine for example), the original form is returned to the patient's record and replaces the fourth copy. The third copy is kept on file by the veterinarian or other quarantine official who signed section II of the form, and the second copy of the form is sent to the chairman of the Rabies Advisory Committee. This committee is established by the Director of Base Medical Services (AFR 161-6, paragraph 4, b (7))and has two basic functions: (1) review the disposition of all cases where rabies exposure is possible and (2) be available to the attending physicians for immediate consultation and recommendations on any animal bite case in progress. The committee will have at least four members, preferably more. The members will include a veterinary officer, when assigned, the officer in charge of Environmental Health Service and at least two physicians. One of these will be from the aerospace medicine services and another from hospital/clinic services.

Exercise (072):

1. What is the antirabies immunization used by the Air Force and what type of immunity does it provide?
2. When is the AF Form 1551 initiated?
3. How many copies are prepared of the AF Form 1551?
4. What is the purpose of the last copy and where is it placed?
5. Who completes and signs section II of the AF Form 1551?
6. What is the EHS responsibility in the Animal Bite Program?

Field Sanitation

AS AN environmental health technician you may be assigned to an air transportable hospital or clinic (ATH/ATC) and be the person responsible for training your mobility team concerning the various aspects of field sanitation. Some of the items you should include in your training program are: water purification, food service sanitation, proper waste disposal practices, and the prevention of heat and cold injuries.

8-1. Water Supply

Under all situations in the field, personnel must be supplied with sufficient water to drink and to maintain personal hygiene. The water for these purposes must be safe for human consumption and should be reasonably free of objectionable tastes, odors, turbidity, and color.

As you recall, many diseases may be caused by organisms found in water. These organisms include those that cause typhoid and paratyphoid fever, bacillary and amebic dysentery, cholera, common diarrhea, and schistosomiasis (snail fever). Other organisms that are suspected of being waterborne are the viruses that cause hepatitis A and poliomyelitis. No direct method has been developed for detecting in water the infectious quantities of these organisms. The water is, therefore, tested for the presence of coliform bacteria. Coliform bacteria are found in great numbers in the excreta (feces) of humans and warm-blooded animals and, when present in water, an indication that pathogenic (disease-carrying) organisms could be present.

073. Cite responsibilities and methods for treatment of the water supply in the field.

Responsibilities. The Air Force Medical Department, Corps of engineers, and the unit commander all work together potable (or safe) water for personnel in the field. Each agency is responsible for specific tasks.

Air Force Medical Department. The bacteriological examination of water, as well as the chlorine residual test under some circumstances, is done by the Air Force Medical Department as part of its responsibility for military water supply. The Air Force Medical Department establishes standards for water quality; inspects water points or sources; advises the proper authorities as to methods of purification that may be used to produce safe water; and after appropriate laboratory or field examination, approves water for consumption.

Corps of Engineers. The Corps of Engineers selects sources of water, establishes water points, and procures and treats water. The selection of water points and the water treatment methods is usually based on examination data provided by the Air Force Medical Department. Sometimes the engineer units transport water to centralized distribution points, known as dry points, for convenient pickup by military units. The usual practice, however, is to provide standpipes or other delivery facilities immediately adjacent to the water point.

Unit commander. Water supply and treatment in the unit are responsibilities of the unit commander. The commander makes certain that the unit has an adequate amount of safe drinking water, enforces the rules of water discipline, and insures that each individual thoroughly understands the danger of drinking unsafe water. The rules of water discipline are: to drink approved water only; to prevent waste of approved water; and to protect water sources by good sanitary practices. It is emphasized that water discipline does not imply teaching troops to do without water. It means using water intelligently and not wasting it.

Treatment of Water. The objective of water treatment is to produce potable water. The treatment processes used in the field are the same as those commonly used in civilian water treatment. These include, but are not limited to, coagulation and sedimentation to remove turbidity, filtration to remove the remaining turbidity and a large portion of the pathogenic organisms, and disinfection to kill any disease producing organisms which have not been removed by sedimentation and filtration. Water coagulation, sedimentation, and filtration are not discussed here, since these are specialized operations performed by the engineers.

Chemical disinfectants. Chlorine is the chemical agent commonly used in purifying water for drinking and other domestic purposes. Calcium hypochlorite, which releases 70 percent of its weight as chlorine, is added to the water in the amount necessary to destroy the organisms (chlorine demand) with some remaining to serve as a continuing disinfectant (chlorine residual). Sudden disappearance of all chlorine probably indicates recontamination. A relatively small quantity of chlorine and contact time of at least 30 minutes is required for satisfactory water disinfection. Experience has proved that in most cases the major portion of the chlorine residual is present after this period. However, an additional contact period of 20 minutes is mandatory before the water can be consumed. Under ordinary field conditions the chlorine residual required is 5 ppm after a 30-minute total contact period. In areas of the world where amebic, bacterial, or viral dysentery or hepatitis A are problems, chlorination (disinfection) requirements recommended by the surgeon will be established by a command directive. Chlorination processes which are properly controlled do not impair the taste and odor of water.

Using the Lyster bag and calcium hypochlorite is the most satisfactory and convenient method for disinfecting water for a small unit in the field. The Lyster bag (fig. 8-1) is issued to units on the basis of 1 per 100 persons. The calcium hypochlorite is issued in ampules for handling convenience. Sufficient chlorine must be added to water to produce a required chlorine residual after a 30-minute contact period. A 5 ppm residual is the standard requirement for field water supplies. On the basis of local diseases and environmental conditions, higher or lower concentrations may be prescribed by the command surgeon.

The Lyster bag must be cleaned before it is used and hung by supporting ropes before it is filled with water. The bag is cleaned with a solution made with one ampule of calcium hypochlorite dissolved in 1 gallon of water. The bag is filled only to within 4 inches from the top of the bag. If possible, the water should be settled and clear (perhaps even strained through a cloth) before it is poured into the Lyster bag. Before the calcium hypochlorite is added, it is first dissolved in a canteen cup with a small amount of water taken from the Lyster bag. As this mixture is poured into the Lyster bag and the water is stirred with a clean stick, faucets are flushed with a small quantity of water. After 10 minutes the faucets are flushed again, and chlorine residual is determined. The sample must not be collected in the same cup or container used to dissolve the hypochlorite.

The use of individual canteens and iodine tablets or ampules of calcium hypochlorite is ordinarily used as a means of supplying safe water when personnel are on the march and the only source is raw water.

Boiling of water. This method is used when disinfecting compounds are not available. It is not considered the best method, since there is no residual protection

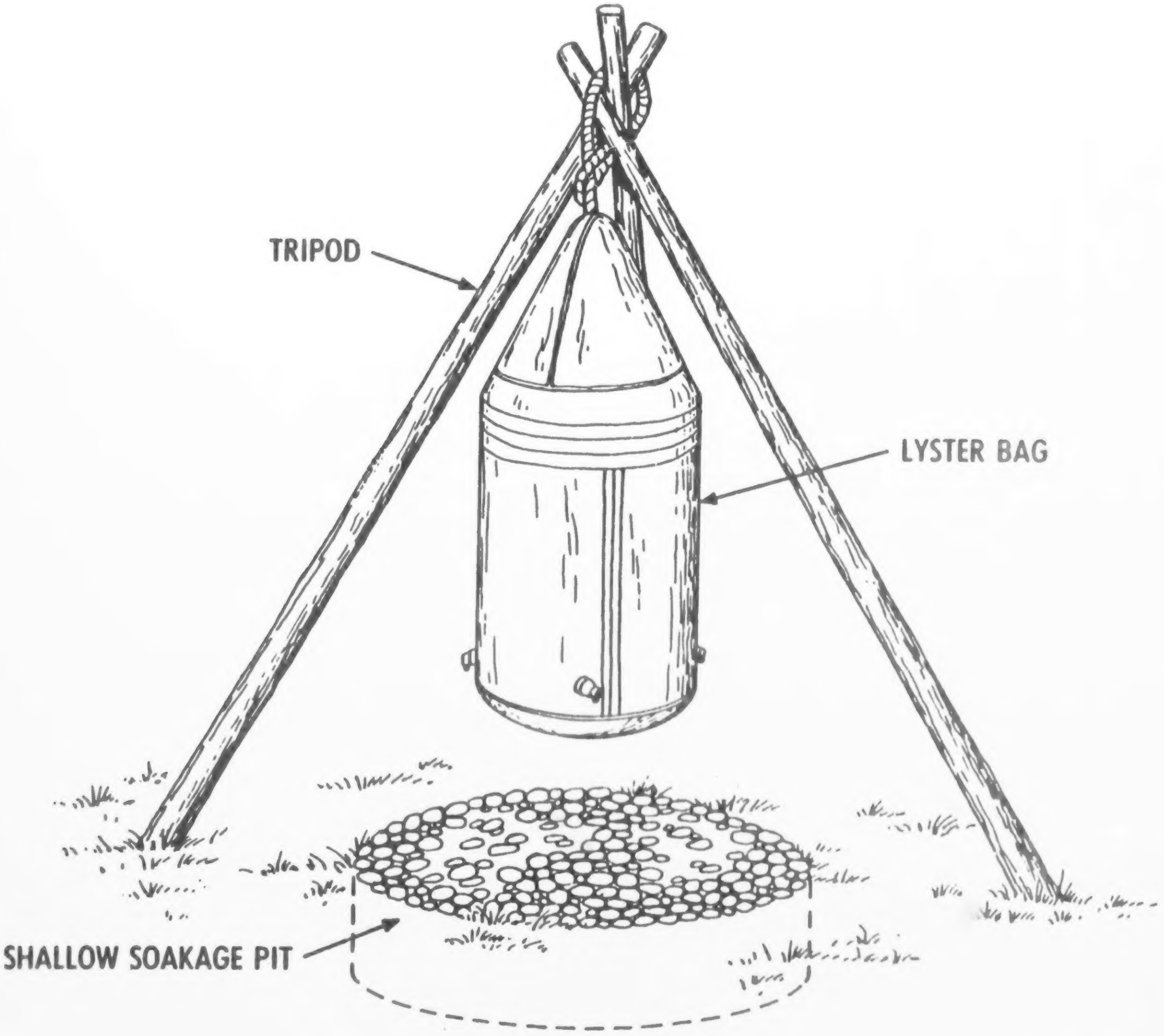


Figure 8-1. Lyster bag setup.

against recontamination. Water at a rolling boil for 15 seconds kills most of the organisms that are known to cause intestinal diseases. Care must be taken to use clean containers for boiling the water.

Determination of chlorine residual. The level of chlorine residual in treated water is determined by use of a comparator. A comparator consists of three plastic tubes and three vials of orthotolidine tablets which are contained in the chlorination kit with the calcium hypochlorite ampules. Each of the plastic tubes has a band of different shade of yellow around it; the lower edge of this band is just above the halfway point of the tube. The lightest shade of yellow indicates 1 ppm; the medium shade, 5 ppm; and the darkest shade, 10 ppm. These figures are printed on the tubes. One orthotolidine tablet is added to the plastic tube and crushed. The water to be tested is then added to a point just below the bottom of the yellow band. The tube is then closed and shaken. The tube should be held in the palm of the hand and kept warm to further color development. If the 5 ppm tube is used, for example, and the orthotolidine reacting with the chlorine produces a color exactly the same as or slightly darker than the yellow band, the chlorine residual is at least 5 ppm. If the color is lighter than the band, the chlorine residual is less than 5 ppm. In this case, the contents of an additional calcium hypochlorite ampule is added to the Lyster bag then the water is retested after another 10-minute period.

Exercises (073):

1. Cite the agency responsible for performing each of the following tasks:
   a. Examination of water; makes recommendations for water treatment.

   b. Ensures unit has adequate amount of safe drinking water; enforces the rules of water discipline.

   c. Selects sources of water; procures and treats water; transports water to the field.

2. What are two chemical agents used for purifying water in the field?

3. What is the amount of time necessary to destroy the pathogenic organisms called?

4. Which method of disinfecting provides no protection against recontamination?

5. After chlorine is added how long is the contact time before the water may be consumed?

8-2. Food Service Sanitation

The conditions under which food is transported, stored, prepared, and served can have a direct bearing on the success or failure of a military mission. Food contaminated with disease germs through improper or unsanitary practices can result in outbreaks of foodborne diseases. You should insure that all persons who handle food maintain the high standards of sanitation.

074. Specify field sanitation requirements for food transportation and storage and for the physical condition of food handlers.

Transportation of Food. The vehicles used for transporting food must be clean and completely enclosed, if possible. Vehicles used for transporting garbage, trash, petroleum products, or similar materials, should not be used for transporting food unless the vehicles have been properly cleaned and disinfected. If bulk quantities of meat and dairy products are to be transported over a considerable distance, refrigerated containers should be used. Every unit should have clean tarpaulins, boxes, or bags to protect food from contamination. Perishable food products must be stocked only at a level that can be used within a short period of time by the unit.

Storage of Food. Immediately upon receipt of food in the food service facility, the unit food service officer or another responsible individual must inspect it. Any food suspected of being unfit for human consumption is referred to an environmental health officer or to the surgeon for his opinion.

Food requiring refrigeration. Food products requiring refrigeration should be stored at a temperature of 45° F. (7° C.) or below. Some units will have a refrigerator and a generator as part of their equipment. Each unit, however, is ordinarily issued an icebox or ice chest with a 200-pound capacity.

Semiperishable food. Vegetables such as potatoes and onions are stored in a dry place on dunnage so that air can circulate around them, thus retarding decay and spoilage. Screened food boxes may be used to keep such semiperishable items for a short period of time. These screened boxes are suspended to permit free circulation of air and to protect the food items from insects and rodents. The food items are covered before they are placed in the boxes to protect them from dust.

Nonperishable food. Nonperishable food items such as staples are stored in metal containers with tightly fitted lids and protected from excessive heat and moisture. Improper storage can result in loss from rodent or insect infestation or from deterioration because of excessive heat or moisture.

Acid food. Acid food and beverage (such as a citrus fruit drink) must never be stored or served in galvanized

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iron cans because they are capable of dissolving the zinc which produce toxic zinc poisoning in the consumers.

Physical Condition of Food handlers. The food handler infected with any communicable disease or acting as a carrier of such diseases is a source of danger. The measures taken to eliminate this danger include medical examinations, daily inspections, instructions in the maintenance of personal hygiene, clean clothing, a provision for adequate toilet and washing facilities. Consideration is given to the nature of the diseases prevalent among the local population before utilizing foreign national personnel in overseas food service facilities. All permanently assigned food handling personnel, including those individuals doing routine inspection of food, must be examined medically prior to assignment. Persons who have been absent from work for any length of time for reasons of communicable illness, including diarrheal illness, should be referred to the appropriate medical facility for a determination of fitness for duty prior to resuming work. Changes to this policy may be directed by your command surgeon based on the local conditions.

The dining steward or other supervisor of the food handling activities inspects all food service personnel daily at the time they report for duty and observes them throughout the work period for signs of illness. Anyone showing evidence of illness, skin disease, infected cuts, or boils should not be permitted to work until approval by a medical practitioner is given. The food handling activity supervisor ensures that washing of hands after visiting a latrine becomes an unfailing habit.

Exercises (074):

Answer the following questions as True (T) or False (F). Correct any false statements.

____ 1. Vehicles used for transporting nonfood items may be used to transport food items if they are refrigerated.

____ 2. Inspection of the food at the food service facility is done only upon use.

____ 3. Acid food and beverage must never be stored in galvanized iron cans.

____ 4. Food handlers who have been absent from work because of a communicable illness must be examined within 90 days after returning to work.

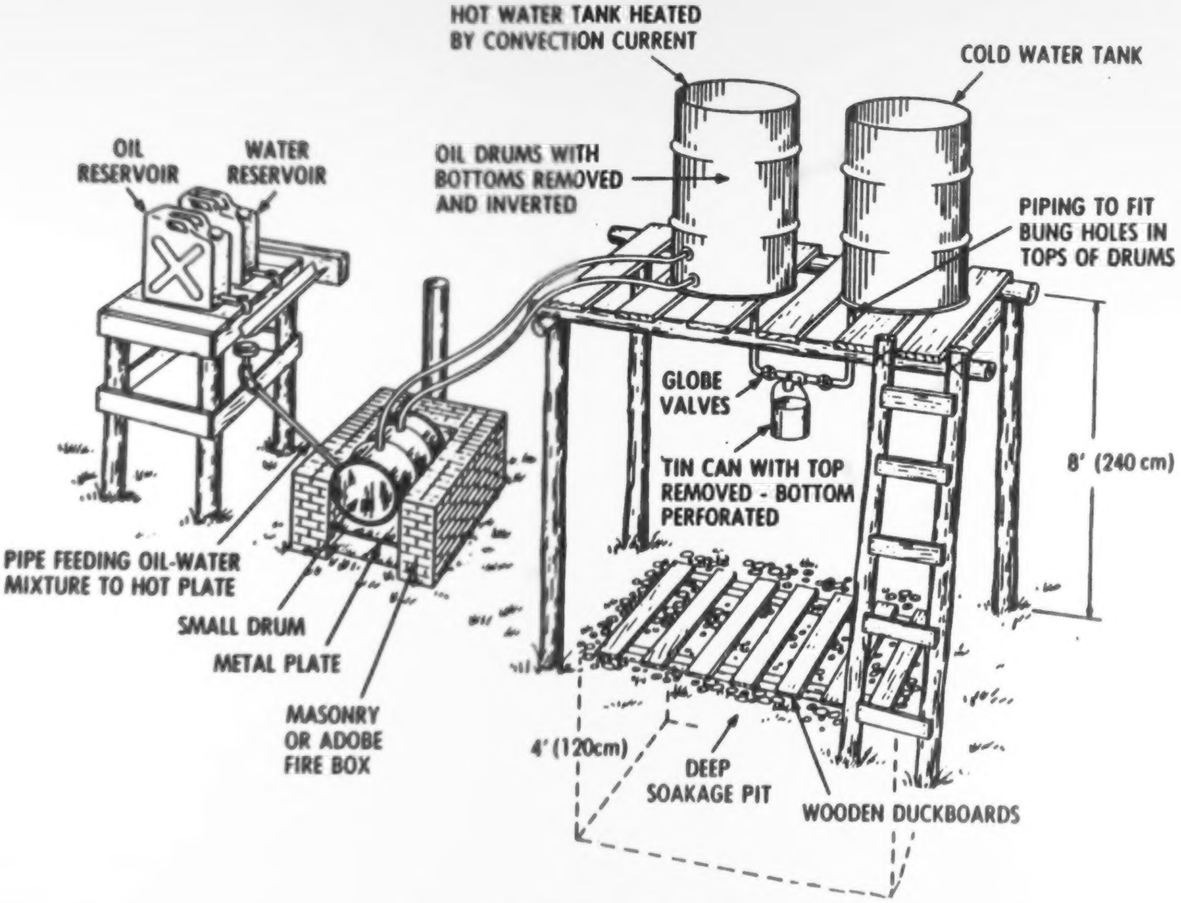
075. State sanitation requirements for the preparation and serving of food.

Cleaning and Disinfection of Utensils. Cooking utensils are cleaned, disinfected, and stored after each use. They are scraped free of food particles, washed in hot soapy water, rinsed in boiling water, rinsed again in boiling water, and allowed to air dry. They are then stored in a clean covered place where they are protected from dust and vermin. There are several types of water heaters. Two types frequently used are the immersion heater and the oil-water flash burner. Figure 8-2, illustrates its use in heating water for showers.

The mess kit laundry consists of three 32-gallon containers which are sufficient to service 80 persons per meal. The first container is filled with hot soapy water; the other two, clear boiling water. When it is impossible to heat the water, a chlorine solution is used in the third container. Each kit is immersed in the chlorine solution for not less than 1 minute. The prescribed solution is 1 level spoonful (standard mess kit spoon) of calcium hypochlorite (70 percent available chlorine) in 10-gallons of water or one package of food service disinfectant, chlorine, in 25-gallons of water. This latter solution is usually sufficient for a dining facility serving approximately 100 persons. If mess kits become soiled or contaminated between meals, they should be rewashed, as described above, prior to use.

Physical Facilities. The physical facilities where food is stored, prepared, and served must be free of rats, mice, flies, roaches, ants, and other vermin which contaminate food and food utensils. Screening and ratproofing methods are used to the greatest extent possible. Repairs are made as soon as the need is indicated. Food and utensils are stored in protected places. Proper waste disposal and control methods are used to destroy arthropods and rodents and to eliminate their feeding and breeding places. When a pesticide is used, the directions on the container must be followed exactly. The use of residual pesticides in food handling areas is limited to crack and crevice treatment only. Extreme care is taken when using pesticides in the presence of food. All food and food contact surfaces must be protected during the spraying or dusting operation. Pesticides must never be stored in the food storage area.

Preparation and Serving of Food. The food service functions are coordinated to eliminate any unnecessary lapse of time between the preparation of the food items to keep them from becoming contaminated, since most foods furnish sufficient nutrient matter for germs to multiply and in some instances to produce large amounts of toxin. Protein foods furnish particularly good media for the growth of germs; therefore contaminated meat, milk, eggs, and cream fillings are especially hazardous. Salads, chopped meats, and sandwich fillings require considerable handling during preparation, thus increasing the opportunities for contamination. Such items are, therefore, prepared immediately before serving or placed promptly in the refrigerator after preparation. When neither course is feasible, as in the case of box lunches, protein foods are avoided unless they



HOT WATER TANK HEATED BY CONVECTION CURRENT
COLD WATER TANK
OIL RESERVOIR
WATER RESERVOIR
OIL DRUMS WITH BOTTOMS REMOVED AND INVERTED
PIPING TO FIT BUNG HOLES IN TOPS OF DRUMS
GLOBE VALVES
TIN CAN WITH TOP REMOVED - BOTTOM PERFORATED
8' (240 cm)
PIPE FEEDING OIL-WATER MIXTURE TO HOT PLATE
SMALL DRUM
METAL PLATE
MASONRY OR ADOBE FIRE BOX
4' (120cm)
DEEP SOAKAGE PIT
WOODEN DUCKBOARDS

Figure 8-2. Shower-oil-water flash burner.

are of the processed or smoked type. Three hours are considered to be the safe limit for these food items to remain unrefrigerated. Since leftover food presents a serious problem, meals are planned to reduce the amount of leftovers. Items held at unsafe temperatures will not be retained as leftovers for reuse. Prepared refrigerated items which have not been placed on the serving line may be retained no more than 24 hours. Certain types of food such as creamed pies or casseroles are not saved under any conditions.

When defrosted or dehydrated foods are exposed to moisture, they are particularly susceptible to spoilage. Dehydrated foods are used at once after reconstitution. One exception is reconstituted dehydrated milk which may be kept under good refrigeration overnight to improve the flavor and solubility of the product. Frozen foods (meat, fruit, etc.) are best defrosted slowly in a refrigerator. When this is not feasible, it is recommended that meat be defrosted by cooking. This is the preferred method for fish, prepared poultry, and vegetables except leafy greens and corn. In arctic operations where fresh vegetables are transported in a frozen state, they should be used quickly after they are thawed and never refrozen.

Proper methods of preparation may reduce certain types of food contamination without impairing the nutritive value of the food. Meat, for example, may contain disease-producing agents that cannot be detected by inspection. Cooking procedures must be such to insure that heat penetrates to the center of the meat and that the meat is well cooked. Personnel must be educated to the fact that pork that is pink has not been sufficiently cooked. All fruits and vegetables are washed before use to eliminate spray residues and to reduce contamination from handling. Since human excreta is used for fertilizer in many areas of the world, food products grown under this condition must not be consumed uncooked unless approval is granted. If the nutritional value of fresh fruits and vegetables cannot be provided in any other way, the surgeon may authorize the use of certain ones, provided the proper precautions are taken. If chemical disinfection is used, the fruit of vegetables are first washed with potable water and soap or detergent and then disinfected by use of chlorine, according to AFR 163-8. Disinfection can also be accomplished by soaking the fruit or vegetables for 30 minutes in a 200 ppm chlorine solution. After the soaking period all bactericidal solution must be washed off with potable water. Certain fruits and berries such as strawberries cannot be properly washed or readily disinfected, and thus they should not be served or eaten raw outside the United States.

Inspection of Food Service Facilities. Food service facility inspections are made for the purpose of identifying basic defects which could cause or spread communicable diseases, recommending corrective measures, and providing specialized information and instructions which help food service personnel understand effective sanitation practices and the importance thereof. Defects of the most serious nature include the use of unsanitary food handling practices, poor personal hygiene, presence of arthropods and rodents, inadequate equipment, and inadequate cleaning and storage facilities. The field sanitation team can be of great assistance to the unit food service personnel in the prevention of these defects.

Exercises (075):

1. How are utensils cleaned and disinfected?

2. What are the requirements for physical facilities where food is stored, prepared, or served?

3. Which types of foods are easily contaminated?

4. How are frozen foods defrosted in the field?

5. How must meat be cooked?

6. What is the purpose of food service facility inspections?

8-3. Waste Disposal

The proper disposal of all wastes is vitally essential in preventing the spread of diseases. The liquid and solid wastes produced under field conditions may amount to 100 pounds per person per day, especially if shower facilities are available. A camp without proper waste disposal methods would soon become an ideal breeding area for flies, rats, and other vermin and could result in filth-borne diseases such as dysentery (amebic and bacillary), typhoid, paratyphoid, and cholera among the personnel.

076f. Describe the methods of waste disposal.

Responsibilities. The unit commander is responsible for the proper disposal of wastes from his unit area. If facilities are not provided, as is often the case when the unit is in the field, the unit commander must arrange for their construction and operation. The Air Force Medical Department is responsible for the inspection of waste facilities and methods of operation. It may recommend changes which will aid in protecting the health and welfare of the personnel.

Methods of Waste Disposal. There are several methods of disposal for the different kinds of wastes, which include human and animal waste, garbage, kitchen and bath liquid waste, and rubbish. The methods selected fro use will depend upon the location of the unit and the military situation. Generally, wastes are buried if the environment, especially soil conditions, permits it.

Human waste disposal. Human waste disposal becomes a problem for both the individual and the unit in the field. During short halts when personnel are on a march, each person uses a "cat-hole" latrine. It is dug approximately 1 foot deep and is completely covered and packed down after use. In a temporary camp (usually 1 to 3 days) the straddle trench is most likely used unless more permanent facilities are provided for the unit. When setting up a temporary camp, deep pit latrine and urine soakage pits are usually constructed. Alternate devices, which may be used to dispose of human waste in the field, are the mound latrine and the bored-hole (fig. 8-3) and pail latrines. As a guideline, eight percent of the male population within the command should be provided with latrines and five percent of the male population provided with urinals. Twelve percent of the female population within the command should be provided with latrines.

Latrines are so constructed to prevent the contamination of food and water. They are located 100 yards from the unit food service facilities and 30 yards from any unit ground water source. For further protection latrines are not dug to the ground water level or in places where pit contents may drain into the water source. They are usually built at least 30 yards from the border of the unit area but within reasonable distance for easy access. A drainage ditch is dug around the edges of the latrine enclosure to keep out rain and other surface water. A simple handwashing device is installed outside each latrine enclosure. These devices should be designed to operate easily and be kept filled with water. Each individual must wash his or her hands after using the latrine.

When a latrine is filled to within 1 foot of the ground surface or when it is to be abandoned, it is closed in the following manner. The pit contents, side walls, and ground surface for a distance of 2 feet from the side walls are sprayed with an approved residual-effect pesticide. The pit is then filled to the ground surface in layers, each layer being compacted. This is to prevent fly pupae from hatching and gaining access to the open air. The excess dirt is compacted over the pit to form a mound at least 1 foot high. The residual pesticide is

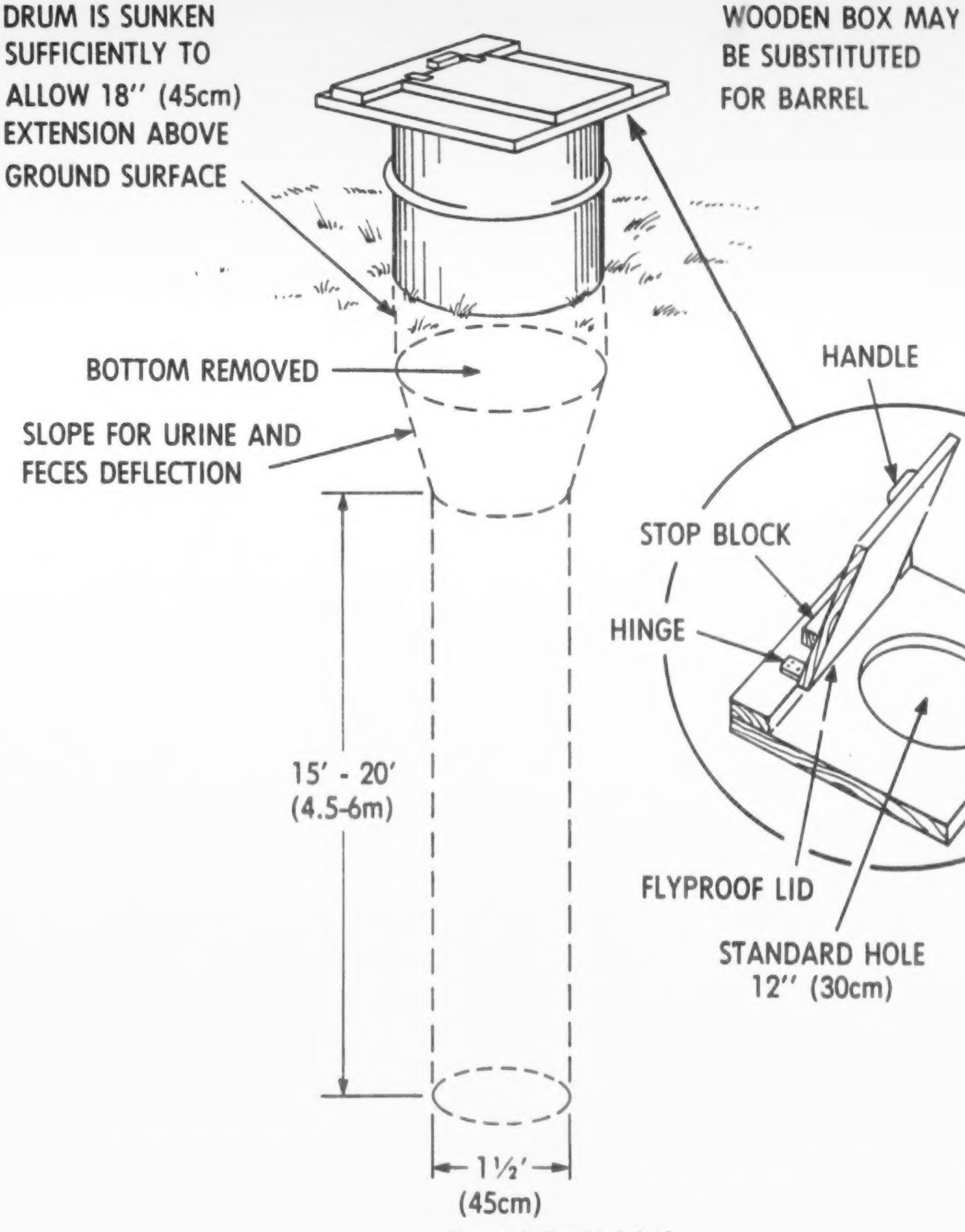
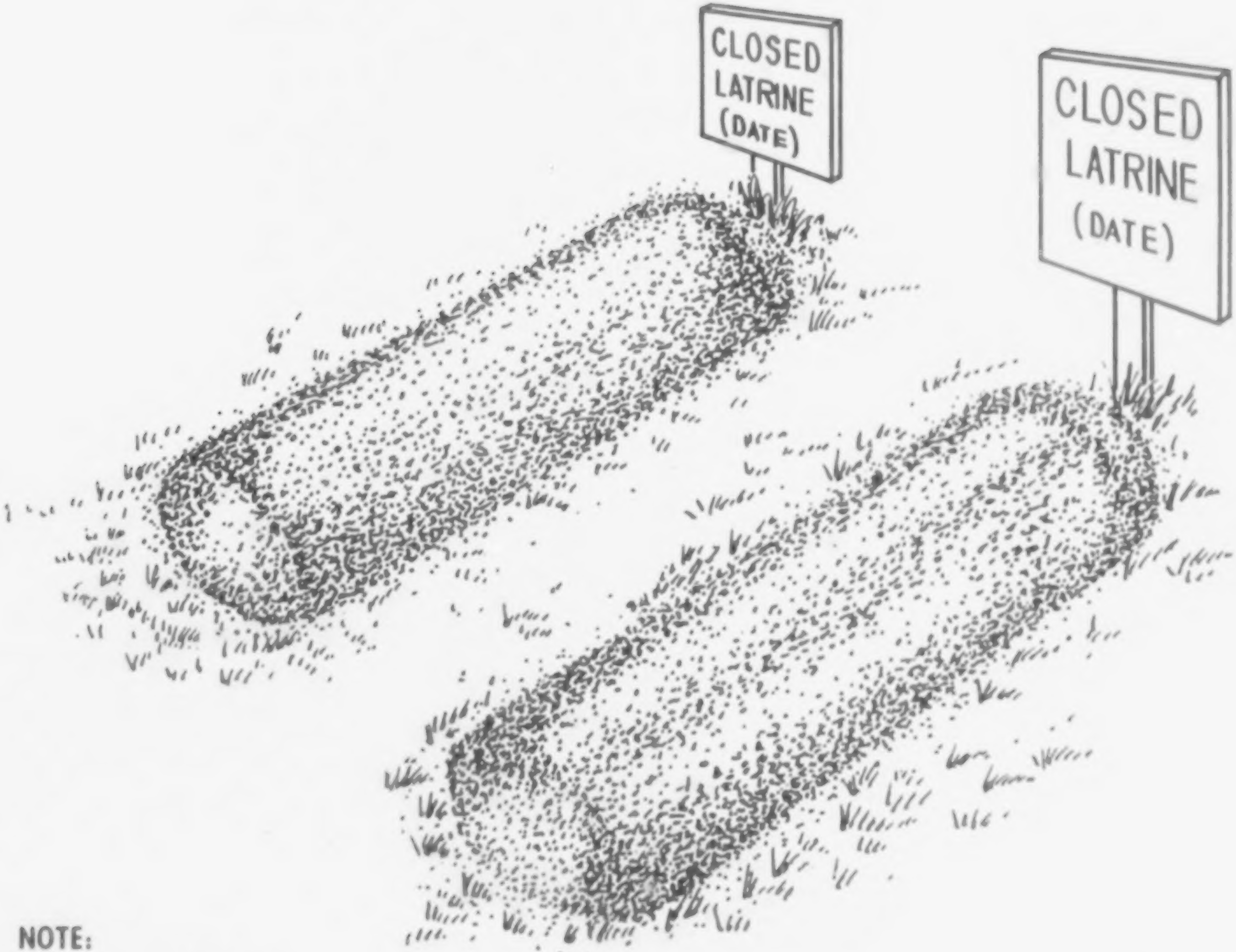

DRUM IS SUNKEN SUFFICIENTLY TO ALLOW 18" (45cm) EXTENSION ABOVE GROUND SURFACE
WOODEN BOX MAY BE SUBSTITUTED FOR BARREL
BOTTOM REMOVED
SLOPE FOR URINE AND FECES DEFLECTION
HANDLE
STOP BLOCK
HINGE
15' - 20' (4.5-6m)
FLYPROOF LID
STANDARD HOLE 12" (30cm)
1½' (45cm)

Figure 8-3. Bored-hole latrine.

again sprayed and a sign is posted with the date and the words "closed latrine" (fig. 8-4).

Straddle trench latrine. A trench is dug 1 foot wide, 1½ feet deep, and 4 feet long. Two feet of length are allowed per person. The number of trenches, each 4 feet long, must be sufficient to serve 8 percent of the command at any time. For example, 100 soldiers would require 16 feet of straddle trench of four 4-foot long trenches. These trenches, which are constructed parallel to one another, are spaced at least 2 feet apart. Since there are no seats on this type of latrine, boards may be placed along both sides of the trench to provide sure footing. As the earth is removed, it is piled at one end of the trench, and a shovel or paddle is provided so that each solder can promptly cover his excreta. Toilet paper is placed on suitable holders and protected from bad weather by a tin can or other covering. The straddle trench latrine is closed, using the same method described previously.

Deep pit latrine. The deep pit is used with the stan-



NOTE:
MOUNDS SHOULD BE
AT LEAST 1' (30cm) HIGH

Figure 8-4. Closed latrines.

dard latrine box which is constructed (ordinarily by the using unit) in the two-, four-, or eight-seat size. A unit of 100 people requires eight latrine seats.

The depth of the pit depends on the estimated length of time the latrine will be used. As a guide, a depth of 1 foot is allowed for each week of estimated use, plus 1 foot of depth for dirt cover. It is not generally desirable to dig the pit more than 6 feet deep because of the danger of the walls caving in. Rock or high ground water levels may also limit the depth of the pit. In some soils supports of planking or other material may be necessary to prevent the walls from caving ine.

In order to prevent fly breeding and to reduce odors, it is necessary to keep the latrine box clean, the lids closed, and the cracks sealed. If a fly problem exists, they may be controlled by application of a residual pesticide. Control efforts should be based upon fly surveys and pesticides applied in accordance with label directions. Pit contents should not be sprayed routinely since flies can develop resistance to pesticides used over and over. The latrine boxes and seats are scrubbed daily with soap and water. Using lime in the pit or burning out the pit contents is not effective for fly or odor control; these methods are not, therefore, recommended. Lime used in conjunction with the insecticides available to units is an ineffective control because the lime neutralizes the insecticide. The deep pit latrine is closed as the others.

Burn-out latrine. The burn-out latrine (fig. 8-5) may be provided when the soil is hard, rocky, or frozen, making the digging of a deep pit latrine difficult. It is particularly suitable in areas with high water tables when digging a deep pit is impossible. The burn-out latrine should not be used when regulations prohibit open fires or air pollution. A unit of 100 people requires at least 8 latrines. Personnel should urinate in a urine disposal facility rather than the burn-out latrine, as more fuel is required to burn out the liquid.

Mound latrine. This latrine may be used when a high ground water level or a rock formation near the ground surface prevents the digging of a deep pit. A dirt mount makes it possible to build a deep pit and still not extend it into the ground water or rock.

Urine disposal facilities. Urine disposal facilities should be provided for at least 5 percent of the command. This means that five pipe urinals are needed for a unit of 100 men. Urine should be drained from the urinals either into a soakage pit (fig. 8-6) or into a standard pit latrine if the urinals are constructed in conjunction with it. The urine may be drained into a pit latrine through a pipe, hose, or trough. If a soakage pit is used, it should be dug 4 feet square and 4 feet deep and filled with rocks, flattened tin cans, bricks, broken bottles, or similar rubble.

If the urine disposal facility is located some distance from the sleeping area, a large can or pail may be placed at a convenient location for use as a urinal at night. This night urinal must be emptied into the urine disposal facility every morning and washed with soap and water.

Garbage disposal. Garbage is disposed of by burial or incineration. Tactical requirements must be considered in either case. The excavated soil must be concealed and smoke and flame may not be tolerated in a tactical situation. In a training situation environmental protection may rule out burning or burying and garbage will have to be collected and hauled away.

Burial. Garbage is the solid or semisolid waste resulting from the preparation, cooking, and serving of food. Garbage must not be buried within 100 feet of any natural source of water, like a stream or well, used for cooking or drinking. The garbage burial area should be a reasonable distance from the kitchen to minimize problems with flies, odor, and appearance.

Incineration. In temporary camps of over 1 week, the garbage is often burned in open incinerations. Excellent types of open incinerators may be constructed from materials which are readily available in any camp area. Since incinerators will not handle wet garbage, it is necessary to separate the solid from the liquid portions of the garbage. This is done by straining the garbage with a coarse strainer such as an old bucket, salvaged can, or oil drum in which holes have been punched in the bottom. The solids remaining in the strainer are incinerated, and the liquids are poured through a grease trap into a soakage pit.

The cross trench and stack incinerator will effectively take care of the waste produced by a large unit. This is an excellent dry trash incinerator. It is not too good for garbage, since wet material tends to disrupt proper draft and it does not burn easily. Two trenches are so constructed that they cross at right angles. The trenches slope from the surface of the ground at the ends to a depth of 18 inches at the intersection. A grate is made from pieces of scrap iron laid over the intersection of the trenches. A stack is made from an oil drum with both ends cut out or with one end cut out and the other end liberally punched with holes to admit draft air. A fire is built on top of the grates; and the waste is added, one shovel full at a time, on top of the fire.

The inclined plane incinerator will dispose of the garbage of an entire battalion, evacuation hospital, or other unit of similar size. Its effectiveness in combustion and the fact that it is not affected by rain or wind make it an excellent improvised device. Time and skill, however, are required in building it. A sheet metal plane is inserted through telescoped oil drums from which the ends have been removed. A loading or stoking platform is built; then one end of the plane-drum device is fastened to it, thus creating an inclined plane. A grate is positioned at the lower end of the plane, and a wood or fuel oil fire is built under the grate. After the incinerator becomes hot, drained garbage is placed on the stoking platform. As the garbage becomes dry, it is pushed down the incline in small amounts to burn. Final combustion takes place on the grate (fig. 8-7).

Liquid waste disposal. Liquid kitchen wastes accumulate at the rate of 1 to 5 gallons per person per day and must be disposed of. Bath and wash water wastes are disposed of in the same manner as kitchens wastes.

Soakage pits. The liquid kitchen wastes are disposed of in the soil by means of soakage pits at or near the

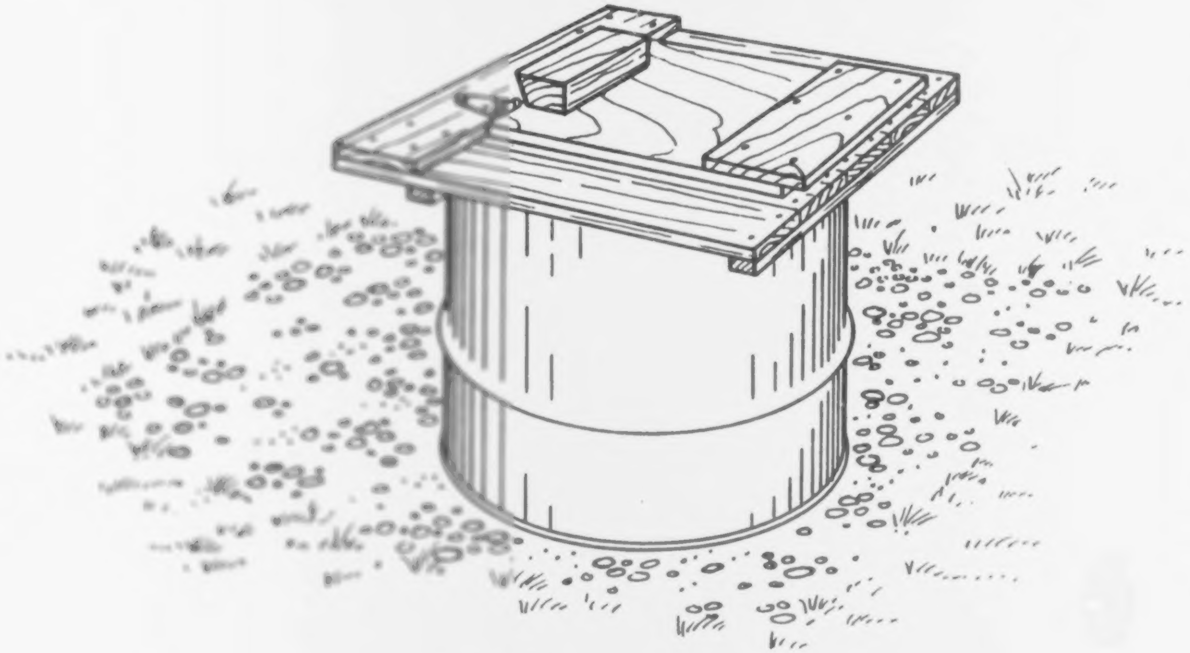


Figure 8-5. Oil-drum burn-out latrine.

place where they are produced. A soakage pit for the disposal of kitchen wastes is constructed in the same manner as the soakage pit for the disposal of urine except that it is equipped with a grease trap.

Soakage trenches. If the ground water table is high or a rock stratum is encountered near the surface, soakage trenches may be substituted for soakage pits. These trenches are extended outward from each corner of a central pit. The pit and the trenches are filled with rock, flattened cans, broken bottles, or other course contact material. A grease trap is employed with this device.

Grease traps. A grease trap is a necessary addition to a kitchen soakage pits and trenches. All kitchen liquids are passed through a grease trap to remove food particles and as much grease as possible; otherwise the soakage pits become clogged and useless. There are two types of grease traps: the filter and the baffle.

To make a filter grease trap an oil drum with the top removed and the bottom perforated is filled 2/3 full with crushed rock or large gravel at the bottom, followed by gravel which has been graded to smaller sizes and then a 6-inch layer of sand, ashes, charcoal, or straw. The top of the drum is covered with burlap to strain out the larger pieces of debris. The burlap is removed daily, burned or buried, and replaced with a clean piece. The filtering material is removed at intervals of once or twice weekly and buried. The barrel is usually placed in the center of the soakage pit with the bottom of the barrel about 2 inches below the pit surface.

The baffle grease trap is the most effective way of removing grease. It is a water tight container divided into entrance and exit chambers by a hanging baffle, the entrance chamber having about twice the capacity of the exit one. The baffle grease trap is usually placed on the ground at the side of the soakage pit with the outlet pipe extending 1 foot beneath the surface at the center of the pit. The liquid waste is strained of solids and debris before it goes into the entrance chamber of the trap. The strainer is filled 2/3 full with loose straw, hay, or grass, Before the grease trap is used, the chambers are filled with cool water. When the warm liquid strikes the cool water in the entrance chamber, the grease rises to the surface and is prevented by the baffle from reaching the outlet to the soakage pit. If the water is warm, proper separation of the grease will not occur. This is often the case in hot climates. The grease retained in the entrance chamber is skimmed from the surface of the water daily or as required and buried. The trap should be emptied and thoroughly scrubbed with hot, soapy water as often as necessary. The efficiency of this grease trap can be increased by constructing it with multiple baffles. Also, a series of baffle grease traps may be used.

Evaporation beds. In a hot, dry climate where heavy clay soil prevents the use of standard soakage pits, evaporation beds may be required. This is true in many parts of the United States. These beds actually involve the processes of evaporation, percolution, and oxidation. Sufficient beds are constructed to allow 3 square feet per person per day for kitchen waste and 2 square feet per person per day for bath waste. The beds are spaced so that the wastes can be distributed to any one of the beds. The beds are constructed by scraping off the top soil and constructing small dikes around them. The surfaces are raked into a series of ridges and depressions with the ridges approximately 6 inches above the

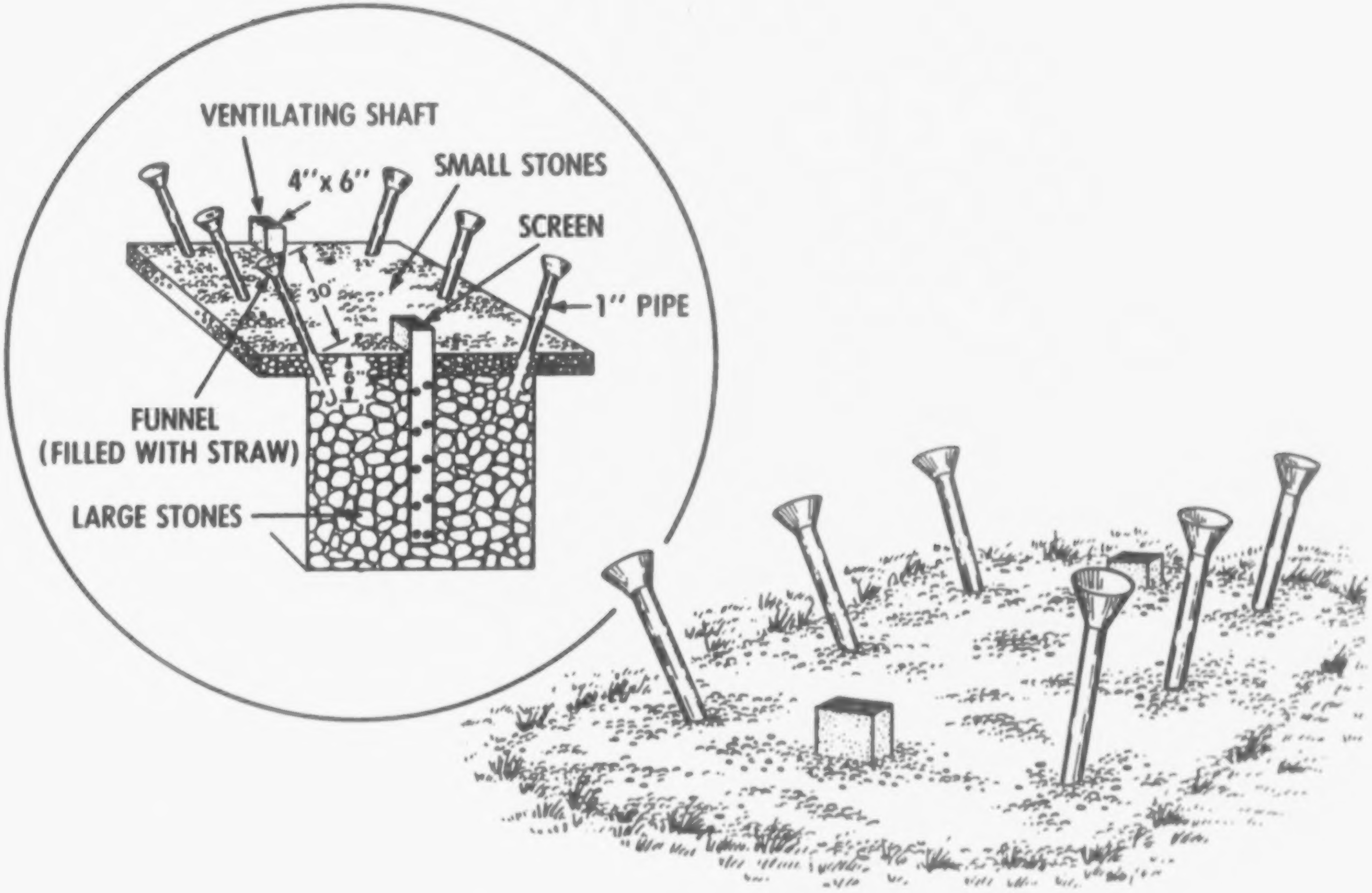


Figure 8-6. Sectional diagram of pipe urinal.

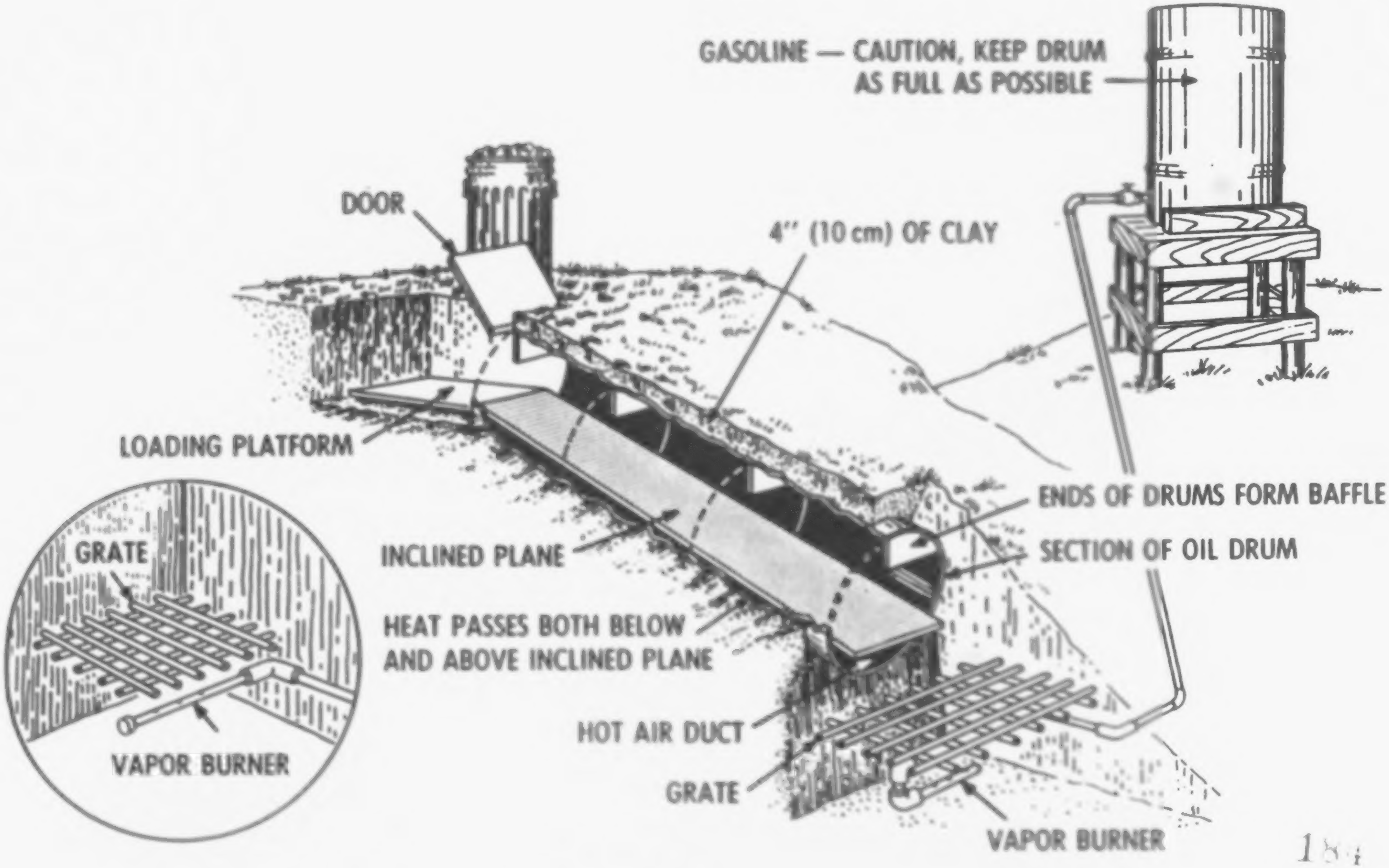


Figure 8-7. Inclined plane incinerator with vapor burner

impressions. These rows may be formed either lenthwise or crosswise as deemed desirable for best distribution of water. In operation, one bed is flooded during 1 day with liquid waste to the top of the ridges which is equivalent to an average depth over the bed of 3 inches and the liquid waste is allowed to evaporate and percolate for 2 days. After another day or two this bed is usually sufficiently dry for respading and reforming. The other beds are flooded on successive days, and the same sequence of events is followed. Careful attention must be given to proper rotation, maintenance, and dosage. It is also essential that the kitchen waste be run through an efficient grease trap before it is allowed to enter the evaporation beds. If these are used properly, they create no insect hazard and only slight odor. There are other possible modifications of waste disposal methods, since sanitary measures must always be adapted to the situation encountered.

Rubbish disposal. Rubbish includes all other unwanted materials (i.e., boards, rocks, scraps of metal, papers, etc.). Combustible rubbish is burned. Noncombustible rubbish is either buried or hauled to a suitable disposal site.

Exercises (076):

1. Latrine facilities must be at least how far from food service facilities and ground water sources?

2. How should latrines be closed?

3. Straddle trenches should be designed to serve at least what percentage of the unit?

4. What type of latrine should be used when the soil is hard, rocky, or frozen?

5. Urine disposal facilities should be provided for what percentage of the command?

6. How should garbage be disposed of in the field?

7. Liquid kitchen waste must always go through what type of device before it is emptied into the evaporation bed?

8-4. Prevention of Heat Injuries

Even though people are in good physical condition, they must go through a period of acclimatization before they can safely do heavy work in hot weather. After becoming acclimatized to heat, they remain acclimatized for a week or two after leaving the hot environment. Then, if they are not reexposed to high temperature, the acclimatization will gradually be lost.

077. Describe how health problems related to heat can be prevented.

Body's Response to Heat. The body's response to heat depends upon the amount of air movement, the relative humidity (amount of moisture in the air), and the amount of radiant heat from the sun and surroundings.

The type and amount of clothing and equipment that a person wears and the manner in which they are worn also have a marked influence on the heat load imposed on the body. Clothing protects the body from radiant heat of the sun or hot objects; but excessive or tightly fitting clothing, web equipment, and packs reduce the ventilation which normally helps to cool the body. During halts, rest stops, and other periods when such items are not required, they should be removed to permit greater cooling.

Other conditions which may increase heat stress and heat injury include infections, fever, recent illness or injury, overweight, previous heat injury, dehydration, exertion, fatigue, heavy meals, and alcohol. For example, feverish reactions from immunizations may increase the susceptibility to heat stress. Immunizations should, therefore, be scheduled so that recovery will be complete before exposure to heat stress. People who appear to be ill or who complain of illness should be provided immediate medical care.

Wet Bulb Globe Temperature (WBGT) Index. The wet bulb globe temperature index is a single numeral by which the air temperature, air movement, relative humidity, and radiant heat can be expressed as favorable or unfavorable for certain types of activities. For information on how to calculate WBGT refer to AFP 160-1. Figure 8-8 shows the necessary equipment for measuring WBGT's.

WBGT indexes should be used as guides (not enforcement standards) in directing acclimatization processes and the regular activities of personnel. They are not to be confused with comfort guides. With a WBGT index over 80, a commander should use discretion in having unacclimatized troops do heavy work or exercises; with an index over 85, he or she should avoid having unacclimatized troops do strenuous activities; with an index over 90, he or she should halt strenuous outdoor activities, provided the military situation permits. If the devices for measuring all of the environmental factors cannot be constructed, the commander should refer to AFP 160-1 as a guide for achieving acclimatization.

Acclimatization to Heat. The major portion of ac-

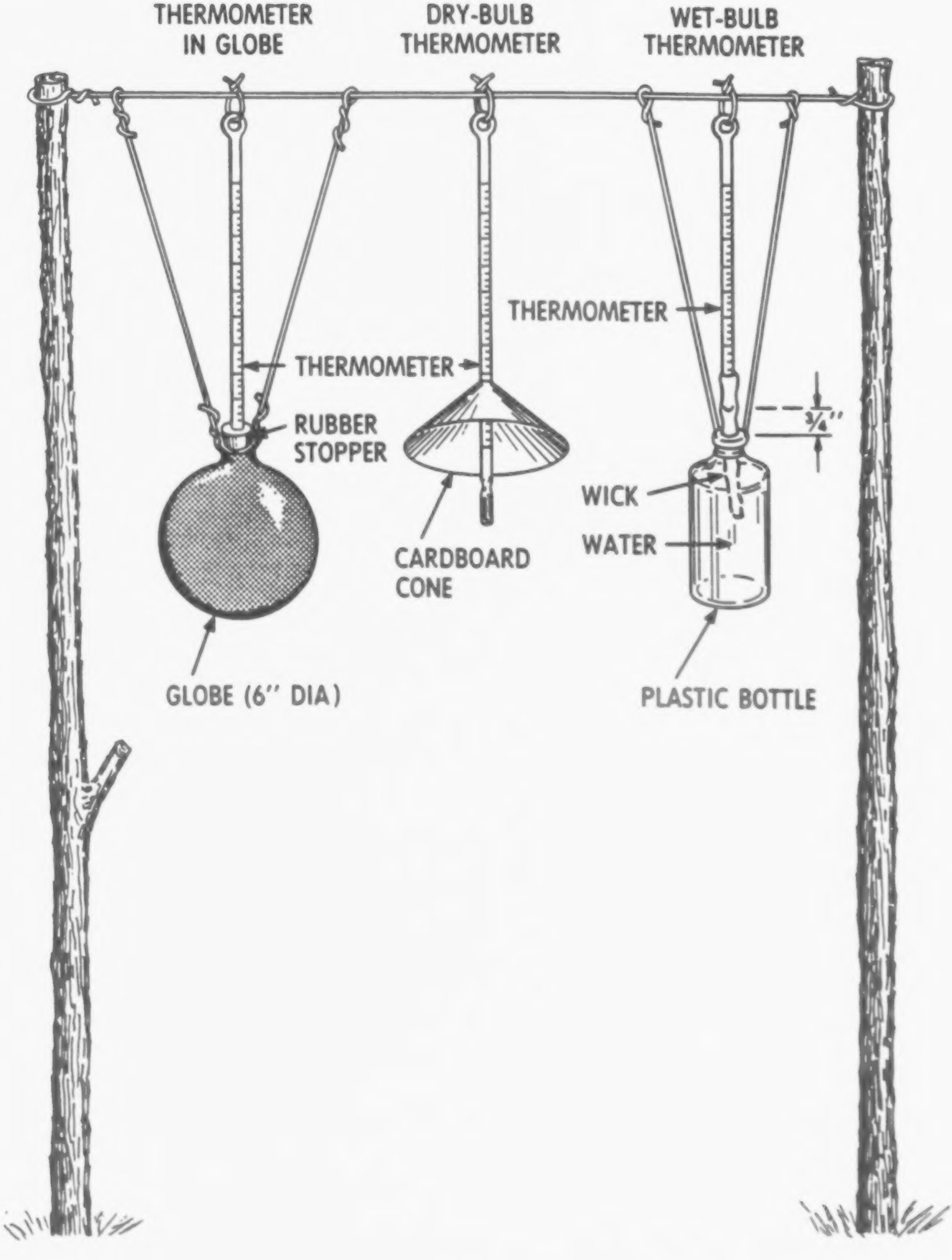


Figure 8-8. Equipment for measuring the air temperature, air movement, relative humidity, and the radiant heat.

climatization to heat takes place automatically during a period from 5 to 7 days, provided the workload is increased gradually, the exposure time to heat is increased gradually, and the troops get plenty or rest between the activity periods and at night and consume adequate water and food. Full acclimization to the heat (the ability to perform a maximum amount of strenuous work) will be reached most quickly if moderate work is begun at the time of first exposure to the heat and is increased progressively within the limits of the individual's tolerance. During the first 2 to 3 days the work periods should be scheduled during the coolest hours of the morning and of the afternoon, with intervening rest periods. These work periods should be gradually extended into the hot part of the day. A guide for increasing the length of the work period is shown in AFP 160–1; however, you may have to modify it somewhat based on the local conditions. You should be able to recognize how acclimated the people are to the environment so you can make recommendations as to whether it is safe for them to continue a given activity. The acclimatized person is alert, energetic, and free of abnormal symptoms. In contrast, the unacclimatized person who is working too hard in the heat becomes dull and apathetic, performs his or her work poorly, and may show symptoms of heat exhaustion.

Water/Salt Requirements. Adequate water intake is the single most important factor in avoidance of heat injury. Water loss from sweat can be as high as one quart (one canteen) an hour or more for long periods. Personnel should be encouraged to drink water with greater frequency than is necessary to quench thirst since the sensation of thirst may not occur until a body deficit of 1–2 quarts of water has occurred. The practice of limiting water intake by personnel will cause heat casualties. Salt supplements are not necessary for individuals who are eating three meals a day and lightly salting their food.

Heat Stress Conditions. There are several medical conditions caused by heat that require first aid. Some of these special conditions are heat exhaustion, heat stroke, heat cramps, sunburn, prickly heat, and fungus infections.

Heat exhaustion. This condition is caused by excessive loss of water and salt from the body. At air temperatures above 95° F the only means by which the body is cooled and heat exhaustion is prevented is through the evaporation of sweat. In the jungle where the humidity is high, for example, sweat does not completely evaporate but runs off the skin; therefore cooling is less efficient and water losses may be greater. The symptoms of heat exhaustion are headache, excessive sweating, weakness, dizziness, and muscle cramps. Also, the skin is pale, cold, moist, and clammy. Heat exhaustion may come on gradually or it may happen suddenly. Few deaths occur from heat exhaustion; however, a severe case which goes untreated can be fatal. A victim of heat exhaustion should be placed in a cool, shady spot immediately and given first aid. The person should then be taken to the nearest medical treatment facility.

Heatstroke. Prolonged exposure to high temperature may cause heatstroke, which is sometimes referred to as "sunstroke." Heatstroke is a medical emergency and calls for prompt emergency treatment. Heatsroke is more likely to strike a person who is not acclimatized to heat. Furthermore, an individual who has heatstroke is more subject to attacks in the future with lessening degrees of response to treatment. The first sign of heatstroke may be stoppage of sweating which causes the skin to feel hot and dry. Collapse and unconsciousness may come suddenly or may be preceded by headache, dizziness, fast pulse, nausea, vomiting, and mental confusion. It is necessary to work fast to save life, since the heat regulators of the body have been damaged and the temperature may rise to as high as 108° F. A victim of a heatstroke should be placed in a cool, shady spot immediately and given first aid as prescribed in AFP 160–1. As soon as possible the patient should be taken to a medical treatment facility, continuing the first aid enroute.

Heat cramps. Heat cramps are painful spasms of the muscles, usually those of the legs, arm, and abdomen. They may be either mild or severe. Cramps are due directly to loss of salt from the body and are relieved when this loss is replaced. The proper first aid is prescribed in AFP 160–1. A victim with severe heat cramps may have to be sent to a medical treatment facility.

Sunburn. Overexposure of uncovered skin surfaces to sunlight causes sunburn. Sunburn is characterized by painful, reddened skin. More severe exposure can result in blistering of the skin. Severe skin burns may result from relatively short periods of outdoor exposure on cloudy as well as on clear days. Sunburn can be prevented by the use of clothing and by gradually increasing the time of successive exposures.

A suntan should be acquired gradually, preferably in the early morning or later afternoon and without exposing too much of the body at one time. A good method is to start with a 5-minute exposure and to increase the exposure gradually at the rate of 5 minutes each day. Even after a good tan has been acquired, excessive sunbathing in tropical or desert areas is never wise. Persons with freckles or auburn hair should be particularly careful, since they are especially susceptible to sunburns. Considerable protection from sunburn is received from the use of the sunburn ointment available for issue to units in the field; however, it does not fully protect the skin against the harmful effects of the sun.

Prickly heat. Prickly heat is an irritating inflammation of the skin associated with excessive sweating. It usually starts around the waist and in the armpits with numerous tiny blisters which itch intensively. As a result of the prickly heat, the skin may become infected, causing troublesome sores. Clean, loose, dry clothing helps to prevent prickly heat. Gradual suntanning seems to help increase resistance to prickly heat. After bathing, a person should dry his skin thoroughly. Too frequent bathing seems to make prickly heat worse, since the natural protective oils of the skin are removed by soap. Severe cases of prickly heat should be referred to the medical officer for treatment.

Fungus infections. Chronic, disabling fungus infections of the skin are more common in hot climates than in cool ones. Excessive sweating causes softening of the skin and makes moist areas such as the groin, crotch, armpits, and feet ideally suited for the growth of fungus. These infections are much easier to prevent than to cure. Following the rules of personal hygiene and taking simple precautions are the best means of preventing such infections. Special control measures for preventing and controlling fungus infections of the feet are delineated as follows:

a. Care of feet. Proper care of the feet, especially keeping them clean and dry, is particularly important in the prevention and control of athlete's foot. Feet should be washed daily and dried thoroughly, especially between the toes. Persons whose feet perspire freely should apply foot powder lightly and evenly twice a day.

b. Treatment of fungus infections of the feet. Active cases of fungus infection should receive prompt and thorough treatment under the supervision of a medical officer. If the disease is prevalent, the feet of all personnel should be inspected at prescribed intervals in order to detect cases early and to insure prompt treatment.

c. Disinfection of floors and equipment. Bathhouse floors and equipment such as mats, benches, and chairs should be scrubbed as often as feasible, preferably each day, with soap and water, flushed with water, and dried out. To aid in preventing athlete's foot, floors should be disinfected with 50 ppm chlorine solution at least once each week and more often if necessary. In warm weather, screened windows should be kept open to permit the direct rays of the sun to shine on the floor. Duckboards, if used in shower baths, should be removable so that they can be scrubbed thoroughly and exposed to sunlight for several hours each day. Two sets of duckboards should be available so they can be alternated daily. Towels, gymnastic suits, and similar articles should not be used by a second person until they have been thoroughly disinfected. Articles that do not become damaged by boiling may be sterilized in this way.

Exercise (077):

1. What is the WBGT?

2. What would you recommend if the WBGT was over 90?

3. How long does it usually take for the body to become acclimatized to heat?

4. What is the single most important factor to remember to avoid heat injuries?

5. Match the description of the heat injury/treatment in column A with the type of heat injury in column B.

Column A

___ (1) Headache, excessive sweating, and muscle cramps caused by excessive loss of water and salt.
___ (2) A medical emergency and calls for prompt emergency treatment. Individual may be more susceptible to attacks in the future.
___ (3) Painful spasms of muscles caused by loss of salt from the body.
___ (4) Painful reddened/or blistering of the skin and prevented by use of clothing and increasing the time of successive exposures.
___ (5) Irritating inflammation of the skin caused by excessive sweating; prevented by wearing clean, loose, dry clothing.
___ (6) Caused by excessive sweating and poor personal hygiene. Prevention involves prompt and thorough treatment and disinfection of floors and equipment.

Column B

a. Heatstroke.
b. Heat exhaustion.
c. Heat cramps.
d. Fungus infections.
e. Prickly heat.
f. Sunburn.

8-5. Prevention of Cold Injuries.

Although the cold temperature in the arctic and other parts of the world presents problems, life in these regions need not be unpleasant and unhealthful. Personnel can learn to maintain health.

078. Describe how health problems related to cold can be prevented.

Diet. Cold temperature alone imposes no need for food intake to be increased; however, operations in cold weather may require extra energy because of the increased physical exertion necessary. The diet provided for personnel contains sufficient calories to meet this energy requirement. People should be encouraged to eat all their food. Should a person eat game, either for the sake of survival or for pleasure, it must be thoroughly cooked, since in certain areas of the north some game species, especially bear, are infected with small parasitic worms called Trichinae. If the meat is undercooked, these worms can cause a serious infection known as trichinosis. Furthermore, the liver of a polar bear or of a bearded seal should never be eaten, since it contains a high concentration of vitamin A, thus making it very harmful to man.

Adverse Effects of Alcohol. In cold weather the human body shrinks the small blood vessels which lie just beneath the skin over the whole body surface, thereby reducing the flow of warm blood to the surface from which heat may be lost by radiation to the surrounding air. When alcohol is taken, one of its effects is to cause expansion of these small vessels. While this gives a temporary feeling of warmth, body heat will be rapidly lost from the large radiating area of the flushed skin. The loss of heat from the core of the body causes a great deal of extra work for the body's heat-producing mechanisms, and they may be unable to withstand this extra demand. When a person's body heat is low, he or she is truly cold; and his or her hands, feet, or any exposed part is more likely to be injured by the cold. Another harmful result of the alcoholic drink is the false sense of well-being, such that the person will neglect to take sensible precautions and fail to recognize the early warning signs of trouble. Furthermore, when the body has been lowered and an injury occurs, shock may develop more rapidly.

Clothing. Clothing for cold weather is designed to afford protection, insulation, and ventilation: protection by covering as large an area of the body as possible; insulation by trapping air which has been warmed by the body and holding it near the skin to prevent loss of heat from the body; ventilation by allowing a two-way exchange of air through the various layers of clothing. This exchange of air prevents overheating and excessive perspiring and at the same time protects against chilling of the body surface. Perspiration, grease, and dirt must not be allowed to remain on clothing, since they decrease its insulating qualities, thus preventing it from retaining heat. The amount of clothing and the way in which it is worn should leave the body slightly cool rather than hot. Also, clothing should be loose enough to allow movement and exercise of the hands, feet, and other parts of the body and thereby maintain proper circulation. Each individual must insure that his or her clothing is clean and dry and that he or she is wearing it in loose layers.

Cold Injuries. It is advisable that personnel in cold weather be paired as "buddies," each having the responsibilities for reminding the other one to take warming exercises at frequent intervals and for watching the buddy for signs of frostbite and other conditions. Conditions especially to be guarded against are hypothermia, trench foot, immersion foot, frostbite, snow blindness, and carbon monoxide poisoning.

Hypothermia. Hypothermia is defined as a low body temperature, specifically a low core temperature. It may be caused by an increase in loss of heat from the body, a decrease in the amount of heat produced by the body, or a combination of both of these. Two important points to remember about the causes of hypothermia are that the body will cool approximately 25 times faster in water than in air and freezing temperatures are not required to produce hypothermia under the right conditions. Even air temperatures as high as 70° F. can produce hypothermia. When people are exposed to wind or rain or even exercising (and sweating), the "cooling" of the body speeds up the chances for hypothermia.

Do not allow the victims of hypothermia to exercise. This is very important, since an increase in movement will cause the cold blood in the arms, legs, etc. to be pumped to the heart. Do not allow this person to stand or walk even a few steps. What you should do is:

a. Handle the person gently.

b. Remove any wet clothing at once. The wet clothing will cause the body to continue to cool off.

c. Protect the person from the wind.

d. Rewarm the victim very slowly by applying heat to the outside of the body (i.e. blankets, etc.).

e. Take the victim to a medical treatment facility to be evaluated.

In addition to not allowing the victim to move about, there are more precautions:

a. In severe cases of hypothermia don't give the victim any hot liquids by mouth.

b. Don't give alcohol to drink.

c. Don't stop any resuscitation attempts until the victim has been rewarmed and evaluated by a doctor.

Trench foot. Trench foot is an injury that results from fairly long exposures of the feet to continued wet conditions, generally at temperature from approximately freezing to 50° F. Although these conditions may prevail in the arctic during certain seasons, they are found more often in temperate climates during the spring, fall, or winter. Rain, sleet, or the thawing of snow or frozen soil may make the ground so wet that boots and socks become wet or damp. If people are inactive, the combination of wet feet, cold weather, and little movement causes changes in the circulation of the blood in the feet. Foot injuries caused by these changes may be very serious; they can lead to the loss of toes or parts of the feet.

Fortunately, trench foot can be prevented by taking care of the feet. The feet should be kept dry and warm. Good circulation should be maintained by exercising the feet and legs. A person can always move the toes and ankles within the shoes. When socks get wet, they should be changed for a dry pair. Before the boots are put back on, the feet should be massaged and rubbed until warm, thus increasing the flow of blood. Socks may be dried under field conditions by putting them under the shirt where the body heat will help to evaporate the moisture. Alternating two pairs of socks in this way is a great aid in keeping the feet dry.

Immersion foot. Immersion foot is similar to trench foot except in the manner in which it is caused. It results from immersion of the feet in water which is below 50° F for a prolonged period, usually in excess of 12 hours. Other portions of the body may be similarly affected.

Frostbite. Frostbite is the injury of tissue from exposure to intense cold. The body parts most easily frostbitten are the cheeks, nose, ears, chin, forehead, wrists, hands, and feet. Frostbitten skin is whitish, stiff, and numb rather than painful. Frostbite can be prevented by wearing the proper amount of warm, loose, dry clothing and by exercising the entire body and massaging the face, hands, and feet periodically to promote good circulation. Troops traveling in cold weather by vehicle, particularly in the rear of trucks, should be allowed to dismount and exercise periodically to restore circulation. Proper footgear and handgear are especially important. Should any part of the clothing become wet, it should be dried or changed at once. Furthermore, it is important not to become overheated and perspire, because the perspiration and damp clothing cause the body heat to escape and allow the body to cool too

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rapidly. This can be avoided by removing the proper layers of clothing before exercising. Should frostbite occur, appropriate actions must be taken immediately as described in AFP 161–11. Care should also be taken to avoid touching cold metal such as the messkit or canteen with the bare hands or lips, since they may freeze to it. Should this occur, the metal should be warmed to release the skin and prevent tearing it.

The condition sometimes referred to as frozen or frosted lungs does not exist. Even though a person exercises hard at 50° F. below zero, no damage is done to his lungs despite the discomfort that is felt. Mild inflammation of the upper airway, such as sore throat or hoarseness, may result; but even this is rare.

Snow blindness. Snow blindness is the effect that glare from an icefield or snowfield has on the eyes. This condition can occur even in cloudy weather. In fact, it occurs more than in hazy, cloudy weather than when the sun is shining. The early stages of snow blindness can be recognized by the scratchy feeling in the eyes when the eyelids are closed. Snow blindness can be prevented by wearing sunglasses at all times when in areas where there is unbroken ice or snow. Should the sunglasses be lost, an emergency pair may be made from a thin piece of wood or cardboard the width of the face by cutting slits into it and attaching strings to hold it over the eyes. Sometimes blackening the eyelids and face around the eyes will absorb some of the harmful rays. Should a person develop a severe case of snow blindness, his eyes should be protected; then he should be taken to a medical facility at once. The same condition that causes snow blindness can cause snowburn of skin, lips, and eyelids. If a snowburn is neglected, the result is a painful reddened skin similar to a sunburn.

Carbon monoxide (CO) poisoning. Carbon monoxide poisoning can be severe, prolonged, and sometimes fatal. It results from inhaling carbon monoxide, which is a colorless, tasteless, and practically odorless gas produced by the incomplete combustion of coal, oil, and other fuels used in such equipment as motor vehicles, field ranges, and lighting and heating devices. This carbon monoxide destroys the ability of the red blood cells to carry the needed oxygen to the body tissues. Carbon monoxide poisoning is usually the result of faulty equipment, improper use of equipment, or inadequate ventilation.

The symptoms of carbon monoxide poisoning come on rapidly and in quick succession. Dizziness, headache, noises in the ears, and throbbing in the temples are quickly followed by a feeling of sleepiness and weakness. Vomiting and convulsion may occur, followed by unconsciousness and death. The skin and lips are often bright red. The individual who is becoming poisoned may realize what is taking place, but may not have enough strength left to get into the fresh air. Under circumstances in which there is muscular exertion or where there are extremes of temperature or humidity, the effects of the poisoning act more rapidly.

The following measures are essential in the prevention of carbon monoxide poisoning:

a. Insure that equipment is in proper working condition, especially the exhaust.

b. Insure adequate ventilation of sleeping areas in which fuel-burning equipment is being used. In cold climates, regardless of the severity of the weather, make sure there is adequate ventilation before going to sleep.

c. Insure adequate ventilation in the cab of a vehicle when the motor is running.

Exercises (078):

1. What effect does consuming alcohol in cold climates have on the body?

2. Why is clothing that provides good ventilation important?

3. What basic measures can be taken to prevent cold injuries?

4. How can you prevent carbon monoxide poisoning?

5. What environmental conditions may cause hypothermia?

6. What are some immediate care measures for hypothermia?

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APPENDIXES

Appendix A. Guide to Medical Terminology
Appendix B. Biostatistic Calculation Formulas

APPENDIX A

GUIDE TO MEDICAL TERMINOLOGY

Oftentimes you will hear words or phrases within the medical profession which seem very difficult to understand. Actually, most terms are just compound words consisting of joined Greek or Latin word roots, combining forms, prefixes, and suffixes. By understanding this you can analyze a word, thus understand its meaning.

Explanatory Terms

1. acute - Sharp; severe; having rapid onset; opposite of chronic.
2. anterior - towards the front; opposite of posterior.
3. cranial - towards the head.
4. caudal - towards the tail.
5. chronic - old, of long duration; opposite of acute.
6. distal - farthest away of remote from point of attachment to back bone; opposite of proximal.
7. dorsal - toward the back opposite of ventral.
8. generalized - over entire area, widely dispersed.
9. lateral - towards the side; opposite of medial.
10. localized - confined, restricted to a limited area.
11. medial - towards the middle; opposite of lateral.
12. posterior - toward the rear; opposite of anterior.
13. proximal - near or closest part; opposite of distal.
14. ventral - towards the belly (in man, the front opposite of dorsal).

Combining Form	*Definition*
a	without
ab	from
abdomin/o	abdomen
ad	toward
aden/o	gland
aer/o	air
alges/i	increased sensitivity
amb/i	both
an	without
angi/o	vessel
anter/o	before
arteri/o	artery
arthr/o	joint
aut/o	self
bi/o	two, double, twice
brad/y	slow
bronch/o	bronchus
carcin/o	cancer
cardi/o	heart
centesis	puncture
cephal/o	head
cerebr/o	part of the brain; cerebrum

Combining Form	*Definition*
cervic/o	neck - neck of uterus
chol/e	gall/bile
chondr/o	cartilage
chrom/o	color
cocc/o	coccus
col/o	colon (bowel)
colp/o	vagina
con	with
cost/o	rib
crani/o	cranium (skull)
cyan/o	blue
cyst/o	bladder
cyt/o	cell
de	from
dent/o	tooth
derm/o	skin
dermat/o	skin
dextr/o	right
di/a	through
dipl/o	double
dors/o	back
drom/o	running with (symptom)
duoden/o	duodenum
dyn/ia	pain
dys	bad, painful, difficult
ect/o	outer
ectomy	excision
ectop/o	misplaced
edema	swelling
emesis	vomiting
emia	blood
end/o	inner
enter/o	small intestine
erythr/o	red
esophag/o	esophagus
esthesi/o	feeling - sensation
eu	good
ex	from
extra	in addition to - beyond
fibr/o	fibrous - fiber
gastr/o	stomach
gen/o	origin, beginning
gingiv/9o	gum
gloss/o	tongue
glyc/o	sugar
gram/o	recording
graph/o	the instrument
gynec/o	women
hem/o	blood
hemat/o	blood
hemi	half
hepat/o	liver
heter/o	different
hom/o	same

Combining Form	*Definition*
hydr/o	water
hyper	more than normal
hypo	less than normal
hyster/o	uterus
infra	below-under
inter	between
intr/a	within
laryng/o	larnynx
later/o	side
luek/o	white
lip/o	fat
lith/o	stone or calculus
log/o	study
lys/o	destruction
macr/o	large
megal/o	enlargement
men/o	menses - menstruation
mening/o	meninges
mes/o	middle
metr/o, meter	measure
micr/o	small
mon/o	single
muc/o	mucus
my/o	muscle
myc/o	fungus
myel/o	bone marrow
nas/o	nose
neur/o	nerve
noct/i	night
o/o	ovum
oid	resembling
oma	tumor
oophor/o	ovary
opia	vision
orchid/o	testes, testicles
orrhagia	hemorrhage
orrhaphy	suture
orrhea	flow
osis	condition
oste/o	bone
ostomy	new opening
ot/o	ear
otomy	incision
pancreat/o	pancreas
par/a	around beyond
path/o	disease
pelv/i	pelvis
penia	lack of
peps/o	digestion
per	through
peri	around
phag/o	eat
pharyng/o	pharynx
phleb/o	vein

Combining Form	*Definition*
plast/o	repair
pleg/o	paralysis
pleur/o	pleura
pne/o	breathing
pneum/o	air
pneumon/o	lung
pod/o	foot
pol/y	many
poster/o	behind, after
pro	before
proct/o	anus or rectum
pseud/o	false
pub/o	pubis
py/o	pus
pyel/o	renal pelvis
pyr/o	fever, fire
rect/o	rectum
retr/o	behind - backward
rhin/o	nose
salping/o	fallopian tube
scler/o	hand
scop/o	examination
sept/o	infection
sinistr/o	left
spasm	contraction
spermat/o	spermatozoa
staphyl/o	grape-like cluster
stasis	stopping, controlling
stomat/o	mouth
strept/o	twisted
sub	under - below
super	above, beyond, superior
supra	above
sphil/o	syphilis
tach/y	fast
therap/o	treatment
therm/o	heat
thorac/o	thorax or chest
trache/o	trachea
troph/o	development
tympan/o	eardrum
ur/o	urine
vas/o	vessel
ventr/o	belly
viscer/o	organ

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MEDICAL ABBREVIATIONS

Abbreviation /Symbol	*Definition*
a.c.	before meals (Latin: ante cibum)
A.M.A.	American Medical Association
A.V.	auriculoventricular or atrioventricular
b.i.d.	twice a day (Latin: bis in die)
B.M.R.	basal metabolic rate
B.M.	bowel movement
B.P.	blood pressure
c	with (Latin: cum)
C	centigrade
Ca	cancer
cbc	complete blood count
cc	cubic centimeter(s)
CCU	cardiac care unit
cm	centimeter(s)
c/o	complains of
cu.	cubic
CVA	cerebrovascular accident, stroke
CVD	cardiovascular disease
D & C	dilatation and curettage
D.D.S.	Doctor of Dental Surgery
D.O.	Doctor of Osteopathy
Dr.	Doctor
ECG or EKG	Electrocardiogram
EEG	electroencephalogram
E.E.N.T.	eye, ear, nose, and throat
E.N.T.	ear, nose, and throat
F	Fahrenheit
G.B.	gallbladder
GI	gastrointestinal
Gm or G	gram(s)
gr	grain(s)
gtt.	drops (Latin: guttea)
GU	genitourinary
Gyn	gynecologic
h.s.	at bedtime (Latin: hora somni)
hypo	below, less than
I & D	incision and drainage
ICU	Intensive Care Unit
I.M.	intramuscular
I.V.	intravenous
kg	kilogram(s)
L	liter(s)
lab	laboratory
LLQ	left lower quadrant
l.m.p.	last menstrual period

Abbreviation/ symbol	*Definition*
L.P.N.	Licensed Practical Nurse
LUQ	left upper quadrant
mcg	microgram(s)
M.D.	Doctor of Medicine
mg	milligram(s)
mg%	milligram(s) percent
mm	millimeters
ml	milliliter(s)
O_2	oxygen
OB	obstetrics
O.D.	right eye (Latin: Oculus dexter)
I.R.	Operating Room
I.S.	left eye (Latin: oculus sinister)
O.U.	both eyes or either eye (Latin: oculus uterque)
oz	ounce
P.	Pulse
Pap test	Papanicolaou test
P.E.	physical examination
pH	hydrogen ion or degree of acidity
P.I.D.	pelvic inflammatory disease
p.o.	by mouth (Latin: per os)
p.r.n.	as needed; as desired (Latin; pro renata)
P.T.	Physical Therapy
q.	every (Latin: quaque)
q.1h	every hour (Latin; quague hora)
q.2h	every two hours
q.i.d.	four times a day (Latin: quater in die)
q.m.	every morning (Latin: quaque matin)
rbc	red blood cells, red blood count
Rh	blood factor (Latin: Rhesus [monkey])
RLQ	right lower quadrant
R.N.	Registered Nurse
RUQ	right upper quadrant
Rx	take (Latin: recipe)
$\bar{s}$	without
S.C.	subcutaneously (Latin: sub cutis)
sed. rate	sedimentation rate
$\overline{ss}$	half (Latin: semis)
staph.	staphylococcus
stat.	immediately (Latin: statim)
S.T.D.	sexually transmitted diseases
strep.	streptococcus
T.	temperature
tab. (s)	tablet(s)
T & A	tonsillectomy and adenoidectomy
TB	tuberculosis
t.i.d.	three times a day (Latin: ter in die)
T.P.R.	temperature, pulse and respirations
ULQ	upper left quadrant
URQ	upper right quadrant
VD	venereal disease
x	times; power

APPENDIX B

BIOSTATISTIC CALCULATION FORMULAS

1. $$\frac{\text{Number of admissions} \times 1000 \times 12}{\text{Average base strength}}$$

2. $$\frac{\text{Number of mandays lost in period} \times 1000}{\text{Mean strength in period} \times \text{days in period (3)}}$$

3. $$\frac{\text{Number of cases in period} \times 1000 \times \text{number of periods in a year}}{\text{Mean daily strength during the period}}$$

4. $$\frac{\text{Number Ill} \times 100}{\text{Total population at risk}}$$

5. $$\frac{\text{Number of cases in year} \times 1000}{\text{Mean daily strength during the period}}$$

Answers for Exercises

CHAPTER 1

References:

001 - 1. Maintaining the combat readiness and effectiveness of the Air Force.

001 - 2. (a) Flight medicine personnel are required to ensure the environmental quality of squadron, alert, and other operational support facilities.
(b) Flight medicine personnel are required to provide support to the environmental health officer regarding the treatment of flying personnel and in solving aerospace medical problems.

001 - 3. Bioenvironmental Engineering.

001 - 4. Bioenvironmental Engineering produces reports on environmental quality that the environmental health office will use during performance of our duties.

001 - 5. Environmental Health Services.

001 - 6. Physical examination and standardization section (PES).

001 - 7. Responding to peacetime and wartime disasters to control environmental and health hazards.

001 - 8. Flight medicine is concerned with each body specifically; Bioenvironmental engineering is concerned with the non-physical causes of illness and injury; Environmental Health is concerned with the entire base population and how to prevent or control illness and injury for that population. Together, these programs meet the mission of the USAF Medical Service to maintain combat readiness and effectiveness.

002 - 1. (1) c.
(2) f.
(3) b.
(4) f.
(5) b.
(6) e.
(7) d.
(8) a.

003 - 1. (1) b.
(2) d.
(3) d.
(4) f.
(5) c.
(6) d.
(7) e.

004 - 1. True.
004 - 2. True.
004 - 3. False. You need to consider your future workload as well, to prepare for needed equipment purchases and funding increases.
004 - 4. True.
004 - 5. True.

005 - 1. 6500.
005 - 2. Introduction, 6500-IN.
005 - 3. Identification list.
005 - 4. The alphabetical index.
005 - 5. The national stock number index.

006 - 1. (a) Telephone ordering is the preferred method of ordering because of seed and simplicity. Use the medical supply section shopping guide: identify items needed by using that item's line number from the guide; telephone your order to the supply clerk, who will prepare your order for pickup.
(b) Use the DD Form 1348-6 for items not listed in the shopping guide; location items in the *Federal Supply Catalog*, complete the form, and forward to the supply clerk.

CHAPTER 2

007 - 1. Reacts with the water in the cell to form hydroxides and causes damage to the DNA, RNA, and protein in the cell.

007 - 2. The genes of the chromosomes control not only heredity but the daily function of the cell.

007 - 3. Pickup and delivery system. Delivers oxygen and nutrients to the cell and picks up waste products and delivers them to the respiratory and excretory systems.

007 - 4. Hemoglobin within the blood has a stronger affinity for carbon monoxide than for oxygen and in the presence of both will bond with CO first, leaving the body tissues to starve for oxygen.

007 - 5. Play a major role in the development of immunity by forming antibodies.

007 - 6. Help blood to clot.

007 - 7. Within the capillaries in the lungs.

007 - 8. Right side of the heart receives deoxygenated blood into the right atrium. From the right atrium, deoxygenated blood passes through a valve into the right ventricle. The right ventricle then pumps the blood through the pulmonary valve into the pulmonary arteries, and on to the lungs. In the lungs blood exchanges carbon dioxide for oxygen.

008 - 1. Supply oxygen to the cell.

008 - 2. In external respiration oxygen leaves the atmosphere and enters the blood while carbon dioxide leaves the blood and enters the atmosphere. Internal respiration involves the exchange of oxygen and carbon dioxide between the blood and cells.

008 - 3. All portions of the respiratory tract are air distributors and only in each alveolus (surrounded by capillaries) is where exchange of oxygen and carbon dioxide takes places.

008 - 4. The diaphram acts as a suction plunger on inspiration and compressing piston on expiration.

008 - 5. The intercostal muscles help to elevate the ribs and expand the chest during inspiration and contract to help compress the chest during expiration. During heavy exercise the large pectoralis major muscles also help to expand the chest.

008 - 6. Chemical changes in the blood, i.e., the carbon dioxide level in the blood.

008 - 7. Major mode of entry for illnesses and toxic substances. Examples are tuberculosis, beta strep, and influenza; occupational illnesses such as silicosis and asbestosis. Even air pollution is an EHS concern.

008 - 8. Inhalation of dust containing crystalline free silica from perhaps grinding of glass or sand blasting.

009 - 1. Filters the blood and excretes wastes; homeostasis of fluids, electrolytes, and acids and bases.

009 - 2. Blood is filtered as it flows through each nephron unit.

009 - 3. Puts less strain on the kidney because it causes the wastes to be less concentrated.

009 - 4. Certain toxic substances (most heavy metals, helogenated and aromatic hydrocarbons) that may be filtered out of the blood may be damaging to the kidney if stored or concentrated.

009 - 5. The production of sperm.
009 - 6. The production of eggs.
009 - 7. The production of eggs and sperm.
009 - 8. Can cause damage to the DNA in the cell, resulting in genetic mutation (called mutagenic effect). Ionizing radiation can also cause damage to the unborn child (called a teratogenic effect).
009 - 9. Produce direct fetal malformations by direct invasion and destruction of fetal tissue.
009 - 10. Can cause sterility, impotence, and scarring of tissues in the reproductive systems.

010 - 1. Prepares food for use by the cells.
010 - 2. Mechanical mixing and more enzymes and hydrochloric acid are added to help break the food down.
010 - 3. Small intestine.
010 - 4. Organ of egestion and allowing for reabsorption of large quantities of water and small amounts of other substances.
010 - 5. Gastritis - inflammation of the stomach; gastroenteritis - inflammation of the stomach and intestines; enteritis - inflammation of the intestines. These conditions may be caused by bacteria, viruses, and toxic chemical.
010 - 6. Large intestine; causes dehydration because the large intestine excretes too much fluid.
010 - 7. Part of the body's defense mechanism.
010 - 8. A communication system for the body constantly keeping us informed of changes in our external and internal environments.
010 - 9. The stimulus received at the synapse causes the release of a chemical acetycholine from the end of the axon. It is this chemical that allows the message to travel across the synapse to the dendrite. Acetycholine is then removed by another enzyme cholinesterase, and the message stops.
010 - 10. Depress the antonomic nervous system; organic solvents such as trichloroethylene.
010 - 11. Phenols and organophosphate pesticides (malathion, parathion) stimulate acetycholine production and inhibit cholinesterase.

011 - 1. External, middle, and outer ear.
011 - 2. Receives sound vibrations from the external ear and transmits them to the ear ossicles.
011 - 3. Equalizes air pressure in the ear with that of the atmosphere.
011 - 4. In the organ of Corti located within the cochlea.
011 - 5. Permanent and temporary hearing losses (or theshold shifts).
011 - 6. Pupil.
011 - 7. When an object is viewed the lens projects an image on the retina containing the rods and cones.
011 - 8. After the lens projects an image on the retina light falling on the nerve endings causes impulses to be generated and relayed to the brain through the optic nerve where they are integrated and interpreted as visual images.
011 - 9. Unprotected exposures to nonionizing radiation can cause cataracts. Ultraviolet radiation creates a photochemical reaction on the very outside layer of the eye, killing cells and producing a sunburned effect. Lasers can cause mild bleaching of the photoreceptors to massive permanent damage to the retina.

012 - 1. (1) Aids in metabolism.
(2) Makes and secretes bile.
(3) Helps maintain proper sugar level.
(4) Makes plasma proteins and antibodies.
(5) Stores vitamins.
(6) Produces heparin and fibrinogen for blood clotting.
(7) Destroys worn out red blood cells.
(8) Detoxifies some substances.
(9) Produces heat.
012 - 2. Solvents (or other chemicals), bacteria, and virus.
012 - 3. By providing a barrier from invasion by bacteria and other harmful microorganisms, helps maintain a constant body temperature, prevents water loss, excretes wastes, receives sensations, produces vitamins and absorbs certain drugs and chemical substances.
012 - 4. Epidermmis and dermis.
012 - 5. Dermis.
012 - 6. Secretion of perspiration, and the capillaries within the dermis dilate to allow warm blood to come to the surface to lose heat.
012 - 7. Contact dermatitis and as mode of entry (i.E., absorption of certain chemicals) into the body.

013 - 1. (1) a.
(2) f.
(3) c.
(4) d.
(5) b.
(6) e.
(7) g.

013 - 2. (1) a.
(2) k.
(3) c,d.
(4) g.
(5) e.
(6) f.
(7) i.
(8) j.
(9) b.
(10) h.

014 - 1. (1) c.
(2) d.
(3) a.
(4) b.
(5) f.
(6) e.

015 - 1. Bacteria are tiny, single-celled organisms that resemble plants in that they have a rigid cell wall.
015 - 2. Shape.
015 - 3. Manner of grouping.
015 - 4. (1) c.
(2) a.
(3) b.
015 - 5. Binary fission.

016 - 1. To aid in motility or survival in nature.
016 - 2. Capsule.
016 - 3. Flagella.
016 - 4. True.

017 - 1. (1) c.
(2) d.
(3) f. Also c, e, and g may cause foodborne illnesses. (You will read more about these organisms later in this volume.)
(4) b.
(5) g.
(6) e. Also f or g may live under aerobic or anaerobic conditions.
(7) a.

018 - 1. Gram-positive; Gram-negative.
018 - 2. Culture medium.
018 - 3. An inhibitory (or selective) medium.
018 - 4. Differential.
018 - 5. Magnesium ribonucleate.
018 - 6. Organisms without the ribonucleate substance are called Gram-negative and stain red.

019 - 1. Exotoxin.
019 - 2. Thermolabile.
019 - 3. Endotoxins.
019 - 4. Thermostable.
019 - 5. Lack of odor, color, or taste.

020 - 1. Alcohols, cheeses, and some antibiotics.
020 - 2. Saprophytes.
020 - 3. Spores.
020 - 4. Bacteria.
020 - 5. Budding, transverse fission, and sporulation.
020 - 6. The substrate.
020 - 7. Individual plants.
020 - 8. Bread mold.
020 - 9. Mold at another temperature.
020 - 10. Because of its prevalence in nature and its association with diseases, food spoilage, and industrial uses in food and medicine production.

021 - 1. Cause a cell to replicate or reproduce them.
021 - 2. Because only a few viruses can be seen with an ordinary microscope.
021 - 3. True.
021 - 4. Rickettsia.
021 - 5. True.
021 - 6. Protozoa.

CHAPTER 3

022 - 1. Whatever (human or other living animal) affords a disease agent a home.
022 - 2. A host who is infectious but does not have any signs or symptoms of the disease.
022 - 3. Humans, birds, arthrodods; rats, mice, dogs, cats, squirrels, etc.
022 - 4. Disease agents are parasites (organisms) which live on or in the body of the host from whose tissues they derive their own food.
022 - 5. Cause some damage to the host but *usually* don't kill it.
022 - 6. First, the parasite may not be able to enter the body or the immunity of the host may overcome the disease agent; second, infection or illness caused by the parasite may be started but be only mild; third, infection may cause disease.
022 - 7. Viruses, some bacteria, malaria, and plague organisms; hookworms and roundworms.
022 - 8. (1) Parasite must enter the body.
    (2) Parasite must find the right place in the body to breed and be able to reproduce itself.
    (3) Must exit the body and be able to survive until it finds a new host.
022 - 9. Ingestion, inhalation, or by skin penetration.

023 - 1. Source, mode of transmission, and susceptible person (host).
023 - 2. Case, carrier, or animal.
023 - 3. Physical contact; droplets, air, and dust; insects; food and water and formites.
023 - 4. By immunizing the susceptible individual; maintaining good health increases resistance.
023 - 5. By routinely recording new cases and by examining all exposed personnel.

024 - 1. Provides a protective coating against many chemicals and parasites.
024 - 2. Hair; sweat glands; hair in the nose; skeleton.
024 - 3. It is lubricated so that the vital organs will slide out of line of direct pressure and sharp objects.
024 - 4 Coughing and sneezing. Cilia (in upper respiratory tract) also helps to move trapped particles out of the body.
024 - 5. By vomiting and diarrhea the body tries to get rid of harmful substance.
024 - 6. Inflammation; WBC's.

025 - 1. Younger children have less immunity and increased exposure to certain disease. Immunity response decreases in the very old.
025 - 2. Differences of habits as well as susceptibility.
025 - 3. Differences in exposures (because of habits, living area, etc.); differences in susceptibility.

026 - 1. Rapid growth and changes in the body tend to increase susceptibility to certain disease agents and conditions.
026 - 2. Definite impairment of immune responses.
026 - 3. It may increase susceptibility.
026 - 4. Tends to make the body less resistant; doesn't allow the body's defense mechanisms to function at peak resistance.

027 - 1. Active.
027 - 2. Artificially acquired.
027 - 3. Contracting the disease.
027 - 4. Receiving the antibody (usually through injection) for the antigen.
027 - 5. In artificially acquired passive immunity the body does not produce any antibodies; thus, this type of immunity is usually short lived.

028 - 1. A proper diet is important for good nutrition. Protection against disease; nutrition deficient condition; the way foods are handled and prepared can lead to foodborne disease outbreaks.
028 - 2. By chlorination, filtration, and education of population using water from wells to boil and/or chlorinate the water.
028 - 3. Greetings (kissing, handshaking, etc.); sexual contact; intimate contact among children.
028 - 4. Industrial workers work around many toxics (lead, mercury, asbestos); some may be exposed to environmental factors (such as too much sun); and disease vectors. They may work with heavy machinery (accidents). Travel may take us to areas where certain diseases are endemic and recreation in itself may lend itself to accidents and exposures to sometimes toxic plant and animal life.

029 - 1. In colder climates people are crowded indoors and our resistance is lower; thus the potential for transmission of respiratory diseases is greater. Warmer climates tend to cause more foodborne illness outbreaks, and hayfever problems with outdoor picnics, gathering, etc.
029 - 2. Determines where disease vectors (also reservoirs) and certain plant life can survive; provides natural barriers to (rivers and mountains) stop human travel and so disease spread. The longitude and latitude of an area also influence the climate.
029 - 3. Determines what food may be grown for our nutrition; includes what animal and plant life may be there (e.g. harmful as well as helpful; disease vectors as well as reservoirs).
029 - 4. Types of industry; storage and distribution of food; types of animal/plant life; degree of stressful living; air pollution; degree of physical activity as available; differing occupations; recreational activity. The "incidence" of disease between urban and rural environments does not seem to differ. However, the types of diseases occurring in each area do vary because of the different aspects of each environment.

030 - 1. Facts or data of a numerical kind, assembled, classified, and tabulated so as to present significant information about a given subject.
030 - 2. a. 100/13 or 7.7 colonies per 100 ml.
    b. 0 (most frequent).
    c. 3.
    d. 0-60.
030 - 3. a. 6040/3 or 464.6 colonies per 100 ml.
    b. 0.
    c. 3.
    d. 0-6,040.
030 - 4. In exercise 2, the median appears to be the single value which most accurately reflects that set of data. Exercise 3 clearly reflects that sometimes we must use all the characterizations (of central tendency) to correctly report a given set of data. To use the mean, mode, median, or range alone doesn't always give a "true" picture of the results.

031 - 1. AF Form 570; Patient Affair Section; and by screening medical records.
031 - 2. a. $\text{NER} = \frac{45 \times 1000}{1200 \times 7} = \underline{5.36}$ man-days lost/1000 pop/day

b. NER = $\frac{\underline{38 \text{ x } 1000}}{2400 \text{ x } 30}$ = $\underline{.53}$ man-days lost/1000 pop/day

031 - 3. a. IR = $\frac{\underline{36 \text{ x } 1000}}{5{,}200}$ = $\underline{6.92}$ /1000 pop/yr

b. IR = $\frac{\underline{48 \text{ x } 1000}}{4{,}200}$ = $\underline{11.43}$ /1000 pop/yr

031 - 4. IR = $\frac{\underline{14 \text{ x } 1000 \text{ x } 12}}{4{,}200}$ = $\underline{40}$ /1000 pop/yr

032 - 1. Observational.
032 - 2. Uncontrolled.
032 - 3. Experimental.
032 - 4. Retrospective.
032 - 5. Cross-sectional survey.

031 - 1. State the problem; i.e., establish the existence of an epidemic.
033 - 2. By confirming diagnosis; comparing the incidence rate with what is "normal" for that time of year, population, and area; asking yourself how significant is this increase in incidence.
033 - 3. Determine the group of people affected and some characteristics about them (i.e., race, age, sex, occupation, residence).
033 - 4. Measures to care for the sick and prevent spread; a detailed investigation of the cases; provisions for any special investigations that might be required (i.e., special lab analysis, civil engineering support, and any other expert consultation deemed necessary).
033 - 5. Several hypotheses may be consistent with all known facts. You must continue to investigate the facts until you find the one hypothesis which your data supports.

034 - 1. EHS; updated as necessary but at least annually; each health care provider and any other personnel responsible for the diagnosing and reporting of diseases.
034 - 2. If the occupational related illness is caused by an infectious agent, then the incidence of disease should be included in the reporting of communicable diseases.
034 - 3. (1) Yes.
(2) Yes.
(3) Yes.
(4) No.
(5) Yes.

035 - 1. a. Making recommendation to the Aerospace Medicine Council on lab tests/immunization requirements for pre-employment and routine physicals.
b. Imposing limits on where personnel may work because of a potential "communicable" condition.
c. Monitoring hospital staff to detect outbreaks of disease or people who may require a limited exposure to their work.
035 - 2. Principles concerning infection, knowledge of hazards in their work areas, and their personal responsibility in infection control.
035 - 3. To detect disease outbreaks and those personnel who may require limited exposure to their work environment.
035 - 4. So that you can accomplish your task of surveying, investigating, and reporting of communicable diseases.

036 - 1. Hospital-acquired infections.
036 - 2. Infections caused by staaphylococcus and Gram-negative organisms such as Klebsiella, *E. Coli*, Alcaligenes, Proteus and Pseudomonas organisms.
036 - 3. Education of employees concerning infection transmission.
036 - 4. Because they are usually antibiotic resistant.
036 - 5. Endogenous.
036 - 6. The environment.
036 - 7. Structural inadequacies within the facility; contaminated devices and equipment being used; unsanitary practices of medical staff or other patients within the hospital.

037 - 1. Controlling and preventing the occurrence of nosocomial infections.
037 - 2. By disease surveillance.
037 - 3. a. Reinforcing the importance of infection control measures.
b. Providing early identification of epidemics.
c. Providing education on infection control.
d. Providing new information from research concerning infection control.
037 - 4. Infection control nurse, lab, BEE, central services, and housekeeping staff.

CHAPTER 4

038 - 1. (1) Yes.
(2) No.
(3) Yes.
(4) Yes.
(5) No.
(6) Yes.
(7) No.

039 - 1. (1) a.
(2) b.
(3) a.
(4) b; may also be an infection (i.e., hepatitis, polio, etc).
(5) a.
(6) a.
(7) b.
(8) b; a (This is both intoxicant and infection—called toxicoinfection).
(9) b.
(10) a.
039 - 2. (1) g.
(2) f; another correct answer could be b.
(3) e; also a and b.
(4) d; other correct responses h,f,b, and a.
(5) a; also h.
(6) c.
(7) b; also f.
(8) h; also a.

040 - 1. The agent; vehicle; consumer; and abuse of foodhandling procedures.
040 - 2. Bacteria.
040 - 3. Potato salad.
040 - 4. Size, age, health, and eating habits.

041 - 1. Sterile bottles, gloves, tongs, spatulas, pencils, paper, and supply of forms (AF Forms 341 and 432 and CDC Form 52.13).
041 - 2. Base environmental health officer.
041 - 3. Infective agent; source or reservoir; mode of transmission; potentially hazardous food; temperature and time to permit growth; susceptible host.
041 - 4. 72.
041 - 5. Inspect the suspected food serving facility.

042 - 1. To obtain data on individuals.
042 - 2. To give a tabular picture of what time the symptoms began.
042 - 3. To give an overall picture of how many people consumed each food item and the incidence of illness in relation to each food.
042 - 4. Four and one-half hours.
042 - 5. Less than 1 hour.
042 - 6. Forty-six percent.
042 - 7. Staphylococcus; block 17.

043 - 1. (1) USDA offices.
(2) FDA officers.
(3) State and local public health authorities.
(4) Base film library.
(5) Command environmental health officer.
043 - 2. (1). AFR 163-8.
(2) AFP 161-22.
(3) AFP 163-12.

(4) AFR 146–7.
(5) Textbooks, such as Longree's *Quantity Food Sanitation.*

044 – 1. False. Gearing training to a particular type of activity, either facility or especially work activity, is best.
044 – 2. False. The abbreviated course is given on initial employment. Annually, foodhandlers should receive a comprehensive course emphasizing personal hygiene and many other subjects.
044 – 3. True.

045 – 1. (1) c.
  (2) a.
  (3) e.
  (4) b.
  (5) f.
  (6) d.
  (7) f.
045 – 2. a. Control source of infection by proper sewage disposal and water purification.
  b. Education of the public on how these conditions/diseases are transmitted; the need for good personal hygiene (i.e., importance of handwashing).
  c. Isolation and treatment of infected individuals (in some cases).
  d. Surveillance (by biostatistics) of waterborne diseases in the area.
045 – 3. Amebiasis (or amebic dysentery); giardiasis.
045 – 4. Schistosomiasis.
045 – 5. (a) MOT - Fecal-oral; Group affected - children in child care centers (poor personal hygiene) and military personnel because of crowding and lack of immunity.
  (b) MOT - Personnel exposed to the body fluids (blood, saliva, semen, etc.) of an infected individual; Group affected - intervenous drug users, male homosexuals, people working in hemodialysis units, lab workers, operating room personnel, and dentists.
  (c) MOT - Transmitted mainly by blood transfusions; Group affected - anyone requiring blood transfusions.

CHAPTER 5

046 – 1. Bacterial meningitis. Although not addressed in your career development course strep, enteroviruses, and influenza may also have a carrier state.
046 – 2. Changes H or N surface antigens.
046 – 3. When minor changes in the virus occur.
046 – 4. An antigenic shift.
046 – 5. An Air Force program designed for monitoring the incidence of influenza in the Air Force and detecting antigenic shifts or drifts.
046 – 6. By education of the susceptible population on how this disease is spread, prevented, and controlled; and by elimination of the source of infection through early diagnosis and treatment.

047 – 1. Chronic, subacute disease that most often affects the respiratory tract but may involve other parts of the body, too.
047 – 2. *Mycobacterium tuberculosis.*
047 – 3. Atypical mycobacteria resemble *Mycobacterium tuberculosis* and can cause tuberculosis like pulmonary infections; however, the treatment regimen and public health concerns differ from those for active TB.
047 – 4. Respiratory, by droplet nuclei.
047 – 5. The bacilli begin to multiply very slowly; some stay at the initial site of infection and others enter nearby lymph nodes and the blood stream. Within a few days the organisms go throughout the body and the white blood cells try to kill or surround them. Some of the TB bacilli die; others remain dormant for many years.
047 – 6. Symtoms may include fatigue, nervous irritability, weight loss, fever, chilliness, night sweats, loss of appetite, or a "cold" that hangs on. Uncommon symptoms that may also occur are coughing, spitting up of blood or blood stained sputum, chest pains, and shortness of breath.
047 – 7. History of symptoms; physical signs; microscopic examination of the patient's sputum; a chest xray.

048 – 1. Chemoprophylactic treatment (usually INH).
048 – 2. If the chest xray and interview are consistent with active TB.
048 – 3. (1) Household contacts of people with active TB.
  (2) Recent convertors.
  (3) People with previously known TB (now inactive) who had received inadequate chemotherapy.
  (4) Positive reactors with abnormal chest xray; positive rectors under 35 years old.
048 – 4. Monitored closely with interviews for signs and symptoms, and liver function tests. If consistent elevations occur, have the patient evaluated by the physician.

049 – 1. One copy is held in suspense in the EHS section, and the original is placed in the patient's medical record.
049 – 2. If positive with the IPPD then the individual should be treated as any other positive reactor.
049 – 3. The annual report is submitted to major command annually in the month of January.

050 – 1. Biostatistics; disease reporting screening and testing; and searching for contacts.
050 – 2. Humans are reservoirs for infection; mobility of population; existence of carriers; rapidly changing viruses; limited effective immunizations/vaccinations.
050 – 3. Avoiding overcrowding; health education; surveillance; isolation and treatment of infectives; immunizations and vaccinations of susceptibles; chemoprophylactic treatment when appropriate.

CHAPTER 6

051 – 1. Mucous membrane.
051 – 2. Meatus, penis, or scrotum.
051 – 3. Cervix.
051 – 4. Fever, malaise, loss of appetite, dermititis.
051 – 5. 8 to 10 weeks.
051 – 6. She may become sterile.

052 – 1. False; smears are sufficient for identifying the presence of gonorrhea but cultures are necessary to confirm diagnosis.
052 – 2. True
052 – 3. False; if treated with any regimen other than 4.8 million units of aqueous procaine penicillin G, then they need to have the monthly serologies (for 4 months) to detect syphilis.

053 – 1. (1) b.
  (2) d.
  (3) a.
  (4) e.
  (5) c.

054 – 1. Darkfield.
054 – 2. VDRL.
054 – 3. Lumbar puncture.
054 – 4. Primary.
054 – 5. FTA-ABS.
054 – 6. Serologies.

055 – 1. False. Herpes simplex virus 2 invades the nerve cells of the infected area and travels to the lower part of the spinal cord where it lies dormant until the body is weakened and the virus become reactivated.
055 – 2. True.
055 – 3. False. It is transmitted to the child during delivery.
055 – 4. True.
055 – 5. False. In men untreated infections can cause infections of

the prostrate and epididymis. PID may develop in women.
055 – 6. False. Test of cure cultures should be done 3 to 6 weeks after treatment.

056 – 1. A throat infection caused by the fungus that causes vaginal yeast infections. This condition is transmitted through oral-genital contact.
056 – 2. Elephantiasis, rectal strictures, and constipation.
056 – 3. Douching, antibiotics, and pregnancy.

057 – 1. Ureplasma; and *Chlamydia trachomatis.*
057 – 2. Hepatitis B.
057 – 3. AIDS.
057 – 4. Urethra.
057 – 5. Women.
057 – 6. Crab.
057 – 7. NGU.

058 – 1. Tested, treated.
058 – 2. Examinations or tests.
058 – 3. Social group.
058 – 4. That they may have become infected.
058 – 5. The name and number of sexual partners.

059 – 1. After diagnostic examination and prior to treatment.
059 – 2. Critical period.
059 – 3. An image of competence and understanding.
059 – 4. Mode of transmission, symptoms, and complications of the patient's disease.
059 – 5. Surprise and disgust.

060 – 1. True; except under legal court order.
060 – 2. True.
060 – 3. True.
060 – 4. False. Also includes civilian contacts residing in territories or possessions of the U.S.; (e.g., Virgin Islands and Puerto Rico).
060 – 5. False. EHS provides Patient Affairs with the statistical data on STD cases.

CHAPTER 7

061 – 1. (1) b.
(2) a.
(3) b.
(4) d.
(5) c.
(6) c.

062 – 1. In insects the "skin" on the outside becomes hardened into an outer skeleton and is called an exoskeleton.
062 – 2. Head, thorax, and abdomen.
062 – 3 It helps us understand how many vectorborne diseases are transmitted.
062 – 4. Changes in form or structure during an insect's development.
062 – 5. Mosquitos, fleas, and flies.
062 – 6. Plant and animal.
062 – 7. Phyla.
062 – 8. Pictorial and written.

063 – 1. Physical control.
063 – 2. Biological.
063 – 3. Chemical.
063 – 4. Draining swamps or any standing water; filling in a marshy area or deepening ponds.
063 – 5. Some bacteria, top feeding minnows and genetic controls such as radiation and chemosterilants.

064 – 1. Classified by the way they are used, mode of action, or chemical composition.
064 – 2. Chemical composition; because you can determine the hazard posed by the pesticides by the effects of the chemicals they are made of.
064 – 3. Anticoagulant; causes capillary damage and may interfere (in sufficient concentration) with the formation of prothrombin (causes blood to clot), therefore resulting in massive internal bleeding.
064 – 4. Organophosphates (phosphorus compounds).
064 – 5. Hydrogen cyanide (HCN) and methyl bromide.
064 – 6. Resistance.
064 – 7. Epidemiology (Division, USAFSAM, Brooks AFB, TX.

065 – 1. True.
065 – 2. False. Only the female mosquito bites. Most subfamilies require a blood meal before eggs are produced. Species of the subfamily Toxorhynchitinae do not blood feed but subsist entirely on plant juices.
065 – 3. False; all mosquito larvae come to the surface for air except those in the genera *Coquillettidia* and *Mansonia*, which obtain air by piercing aquatic plants.
065 – 4. True.
065 – 5. True.
065 – 6. (1) a.
(2) b.
(3) c.
(4) a,b,c,d,e.
(5) d.
(6) c.
(7) d.

066 – 1. Light-baited New Jersey traps.
066 – 2. Some important vector species are not phototactic.
066 – 3. Attract more mosquito species, increase yield, eliminates trash insects, and male mosquitos.
066 – 4. To determine where mosquito breeding sizes are located.
066 – 5. *Aedes aegypti.*

067 – 1. Useful tool for organizing trap data and comparing different time periods or locations.
067 – 2. One trap operated for 1 night.
067 – 3. The total number of females trapped divided by the total trap nights.
067 – 4. To show a population fluctuation in a specific species or particular group of mosquitos. Both TI and STI are valuable in planning mosquito control.
067 – 5. TI equals 7.4.

068 – 1. Through chemical action of poisoning or through physical and chemical action to keep larvae from breathing.
068 – 2. By applying residual pesticides on surfaces where they rest or by space spraying.
068 – 3. Dragonfly larvae; *Gambusia affinis* minnows; Fundulus species of minnows (salt water); *Telapia mossambica* (tropical fresh water fish); certain mosquito larvae subfamilies - Toxochynchites and Psorophora and the BTI bacteria.
068 – 4. Anopheles spp.
068 – 5. The use of two or more types of control methods to solve a pest problem.

069 – 1. (1) c.
(2) b.
(3) b.
(4) d.
(5) c.
(6) a.
(7) e.
(8) e.
069 – 2. By applying pesticides to the animal hosts and to the infested areas.
069 – 3. Personal cleanliness.
069 – 4. Proper sanitation; screening houses; and using insecticides to kill the adults and larvae.
069 – 5. By intimate personal contact and using and wearing infested clothes, bedding, towels, etc.
069 – 6. DEET (di-Ethyl Toluamide).

069 - 7. Avoidance/control.

070 - 1. Plague, endemis typhus, leptospirosis, Rocky Mountain spotted fever, scrub typhus, tularemia, salmonellosis, trichionosis, and rat-bite fever. Many of these diseases are actually transmitted by arthropod vectors (fleas, ticks, etc.) living on the rodent reservoir for the disease agent.
070 - 2. Adequate environment sanitation.
070 - 3. Anticoagulants; because a child or an animal would have to consume a large potion to be badly hurt.
070 - 4. Arrive with all identification characteristics complete and undamaged.
070 - 5. Kill, wash, and comb the rodent and ship only the ectoparasites in a 70 percent alcohol solution.
070 - 6. Epidemiology (Division, USAFSAM/EKED, Brooks, AFB, TX 78235.

071 - 1. Central nervous system.
071 - 2. 15 to 25 days.
071 - 3. a. 0.
b. 1.
c. 2.
c. 1.

072 - 1. The human diploid cell rabies vaccine (HDCV). An example of artificial active immunity; causes the production of antibodies by the body.
072 - 2. In the emergency room when the patient is first seen at the medical facility for the animal bite.
072 - 3. Original and three copies.
072 - 4. Acts as a suspense file and is placed in the patient's medical record.
072 - 5. Veterinarian or other quarantine official.
072 - 6. They must monitor the administrative aspects of the program.

CHAPTER 8

073 - 1. a. AF Medical Department.
b. Unit commander.
c. Corps of Engineers.
073 - 2. Chlorine (calcium hypochlorite) and iodine.
073 - 3. Contact time.
073 - 4. Boiling.
073 - 5. 30 inutes. After 10 minutes the residual is checked and if the desired residual is obtained then the water must be allowed to stand an additional 20 minutes before use. If additional chlorine must be added, a 30 minute contact time must be allowed before the water can be used.

074 - 1. False. They must be properly cleaned and disinfected prior to transporting food items.
074 - 2. False. Food must be inspected immediately upon receipt at the food service facility.
074 - 3. True.
074 - 4. False. Foodhandlers must be examined prior to resuming work to ensure that they are no longer communicable.

075 - 1. Food is scraped off the utensils, then washed in hot soapy water, rinsed in boiling water, rinsed again in boiling water, then allowed to air dry. If no hot water is available the second rinse may be a chlorine dip.
075 - 2. Must be free of rats, mice, flies, roaches, ants, and other vermin which contaminate food and food utensils.
075 - 3. Protein foods; meat, milk, eggs, etc.
075 - 4. Slowly in the refrigerator or by cooking.
075 - 5. Well-cooked, so that the heat penetrates to the center of the meat.
075 - 6. To identify basic defects which could cause or spread communicable disease, recommend corrective measures, and instruct food service personnel on sanitation practices and their importance.

076 - 1. 100 yards from food service facilities and 30 yards (approximately 100 feet) from unit ground water sources.
076 - 2. When filled to within 1 foot, the entire area (and pit contents) are sprayed with an insecticide for a distance of 2 feet from the side walls. The pit is filled with layers of dirt and each layer is compacted to the surface. An exceed mound of 1 foot of dirt cover is added. A sign is then posted stating "closed latrine" with the date.
076 - 3. 8 percent.
076 - 4. Burn-out latrine.
076 - 5. 5 percent.
076 - 6. By burial or incineration.
076 - 7. Grease trap (filter or baffle).

077 - 1. A single number by which the air temperature and movement, relative humidity, and radiant heat can be expressed as favorable or unfavorable for certain types of activities.
077 - 2. Stop any strenuous outdoor activities.
077 - 3. 5–7 days.
077 - 4. Drink enough water—more than is necessary to quench the thirst throughout the day.
077 - 5. (1) b.
(2) a.
(3) c.
(4) f.
(5) e.
(6) d.

078 - 1. Alcohol causes the capillaries on the skin to expand, allowing for a rapid loss of body heat.
078 - 2. Good ventilation allows air to be exchanged through the layers of clothing, preventing overheating and excessive sweating and at the same time protecting chilling of the body surface.
078 - 3. Wear clean, dry clothing (loose clothing in many layers). Cover as much of the body as possible. Eat an adequate diet; practice good personal hygiene, and whenever working or traveling in cold climates always use the "buddy system."
078 - 4. Insure that equipment is in optimum working condition; maintain adequate ventilation in vehicles and in sleeping areas.
078 - 5. Temperatures less than 70° F. If it is raining or windy, or the person is sweating (such as when exercising) the chance for a hypothermic condition to develop is greatly increased.
078 - 6. Keep the victim still, remove any wet clothing, protect from the wind, warm the victim slowly (externally with blankets), and have the victim evaluated by a medical authority.

1984-544-008/2597 AUGAFS,AL(850347)700

STOP- **1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.**
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

90850 01 23

CONTROL OF COMMUNICABLE DISEASES

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (001) What is the *primary* reason for the present organization of the USAF Medical Service?

   a. To standardize the organization throughout the USAF.
   b. To provide an orderly transition for personnel who are assigned to new medical units.
   c. To improve management technique within the Medical Service.
   d. To avoid organizational confusion during transition to war and to conserve resources.

2. (001) What is the Aerospace Medicine Council's function within the Aerospace Medicine Program?

   a. To review work done by Aerospace Medicine personnel and to provide systems for improving the efficiency of the Aerospace Medicine Program.
   b. To provide systems for improving the administrative procedure in the Aerospace Medicine Program.
   c. To correct problems occurring within the medical facility.
   d. To set standards for review of legal charges brought against USAF medical personnel.

3. (002) Identify the federal agency responsible for grading and inspecting meat, poultry, and vegetable products prior to sale.

   a. Centers for Disease Control.
   b. US Department of Commerce.
   c. US Department of Agriculture.
   d. US Public Health Services.

4. (002) The US Department of Commerce provides what type of inspection program to seafood producers?

   a. A mandatory seafood inspection program, within the continental United States.
   b. A joint-service seafood inspection program regulated by the US Department of Agriculture.
   c. A voluntary inspection program for seafood, seafood processing plants, and the waters from which the seafood is harvested.
   d. A required seafood inspection program for products imported from foreign nations.

5. (003) Within the medical material system, a consumable supply item is an item that

   a. does not lose its identity when used but has a life expectancy of less than two years.
   b. loses its identity when used, or cannot be used twice for the same purpose, or isn't durable enough to last one year.
   c. can be used more than once for the same purpose but is durable for less than two years.
   d. is durable for less than two years but can be used repeatedly.

6. (003) Within the medical material system, items which have a unit cost of less than $40.00 and are *not* medical in nature are termed

   a. nonmedical supplies.
   b. expendable supplies.
   c. non-investment supplies.
   d. investment supplies.

7. (004) Upon receiving a request to supply the Environmental Health Office's fund requirements for the upcoming fiscal year's supplies, you should *first* study the

   a. last year's supply costs.
   b. last six months' supply costs.
   c. last year's inflationary trends.
   d. workload requirements for the foreseeable future.

8. (004) Within the medical material system, about how far in advance of a fiscal year does budgeting for supplies and equipment usually occur?

a. Three months.
b. Four months.
c. Five months.
d. Six months.

9. (005) Which digits in the national stock number 6500-00-305-7220 indicate the Federal Supply Class Group?

a. 6500.
b. 00.
c. 305.
d. 7220.

10. (005) What portion of the Federal Supply Catalog discusses use of the catalog?

a. The alphabetical index.
b. The item identification section.
c. The introduction, 6500-IN.
d. The management data list.

11. (006) Regardless of which method of supply ordering you use, each delivery of supplies and equipment will be accompanied by

a. back-ordered items.
b. a shopping guide.
c. line item cards.
d. an issue list.

12. (006) How should you order supplies when a supply item you need doesn't appear in the shopping guide?

a. Use the issue list.
b. Complete a DD Form 1348-6.
c. Use line item cards.
d. Complete an AF Form 601b.

13. (007) What is the *major* function of the hemoglobin contained in the red blood cells?

a. By forming antibodies, hemoglobin plays a major role in the development of immunity.
b. Hemoglobin transports oxygen to the cell and carbon dioxide away from the cell.
c. Hemoglobin supplies nitrogen to the cell and aids in the clotting of blood.
d. Hemoglobin transports oxygen to the cell and stimulates the lymphocytes to produce antibodies.

14. (008) Pneumoconiosis may be caused by inhalation of

a. acid-mists.
b. bacteria or viruses.
c. dust.
d. carbon dioxide.

15. (009) The major function(s) of the urinary system are to

a. pick up waste products from the cells and delivery them to the kidney.
b. filter the blood and excrete waste products from the blood.
c. neutralize waste products and return them to the body.
d. transport gases to body tissues.

16. (010) Most of the digestion and absorption of food in the digestive system occurs in the

a. large intestine.
b. stomach.
c. liver.
d. small intestine.

17. (011) A noise-induced hearing loss results from damage to the

a. temporal bone in the inner ear.
b. stapes in the middle ear.
c. sensory nerve endings in the cochlea.
d. acoustic nerve (Nerve VIII).

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18. (011) Unprotected exposures to UV radiation (i.e., the type produced by arc welding) cause

a. a "bleaching" of the photoreceptors on the retina.
b. a photochemical reaction in the outside layer of the eye.
c. cataracts.
d. a change in pigment color.

19. (012) An Environmental Health concern of the skin is

a. enteritis.
b. contact dermatitis.
c. pneumoconiosis.
d. contact hepatitis.

20. (013) The ingestion of mercury may have an adverse effect on all of the following organs or organ systems *except* the

a. reproductive system.
b. liver.
c. urinary system.
d. gastrointestinal system.

21 (014) Food for the cell is stored in the

a. nucleus.
b. cell wall.
c. vacuoles.
d. protoplasm.

22. (015) Rod-shaped bacteria are known as

a. cocci.
b. bacilli.
c. spirilla.
d. protozoa.

23. (015) Paired cocci organisms are also known as

a. streptococci.
b. staphylococci.
c. diplococci.
d. spirococci.

24. (016) To survive in unfavorable conditions for long periods, certain bacteria concentrate their protoplasm into a little round ball called a

a. spore.
b. capsule.
c. vacuole.
d. flagellum.

25. (017) Which of the following classifications of bacteria is of particular importance from a public health viewpoint?

a. Mesophilic.
b. Thermophilic.
c. Thermoduric.
d. Psychrophilic.

26. (018) Chemicals added to culture media to allow some bacteria to grow and to stop the growth of other bacteria are called

a. identifying supplements.
b. mediators.
c. inhibitors.
d. selectors.

27. (019) Cooking food may kill bacteria, but the food may not be safe if the toxin is

a. thermolabile.
b. thermostable.
c. thermoduric.
d. thermophilic.

28. (020) Fungi species which receive nutrition from dead or decaying material are called

a. saprophytes.
b. parasites.
c. pathogenics.
d. endotoxics.

29. (021) One microscopic organism that is *not* classified as a plant or an animal is a

a. yeast.
b. fungus.
c. virus.
d. mold.

30. (022) A primary or definitive host may be defined as the host in which the disease agent

a. must live to survive.
b. attains its maturity and goes through a sexual stage.
c. lives but does not go through a sexual stage.
d. lives until it exits and infects another host.

31. (023) The single most effective personal hygiene practice in stopping the spread of disease is

a. frequent bathing.
b. covering the mouth when sneezing.
c. wearing clean clothes.
d. frequent handwashing.

32. (024) Larger doses of a chemical are necessary to harm the body after the body develops

a. tolerance.
b. hypersensitivity.
c. immunity.
d. a reactive defense syndrome.

33. (025) Intrinsic host characteristics do *not* usually relate to disease occurrence by determining

a. degree of exposure.
b. differences in susceptibility.
c. the possibility of any specific immunity in the population at risk.
d. nutritional status.

34. (026) The general health status of the host does *not* include considerations of

a. physiologic state.
b. pre-existing disease.
c. race or ethnic group.
d. stress.

35. (027) Artificially acquired passive immunity is acquired by

a. actually contracting the infection.
b. the newborn infant from the mother.
c. getting a vaccination.
d. getting the antibodies themselves for the antigen.

36. (027) "Herd immunity" is created by

a. treating infected individuals only.
b. locating the source of infection and treating it.
c. vaccinating a high percentage of the entire population.
d. monitoring disease trends in the population.

37. (028) Improper disposal of human wastes may contribute to outbreaks of

a. trichinosis.
b. hepatitis A.
c. lice infestations.
d. scabies.

38. (029) The transmission of vector-borne diseases (such as malaria) is dependent upon which environment?

a. Physical.
b. Biological.
c. Socioeconomic.
d. All of the above.

39. (030) Calculate the arithmetic mean from the following list of numbers: 42, 6, 19, 72, 11, 11, 12, 22, 75.

a. 27.
b. 29.
c. 30.
d. 32.75.

40. (030) Calculate the median from following list of numbers.

9, 2, 1, 15, 5, 6, 8, 1, 3.

a. 1.
b. 2.
c. 4.
d. 5.

41. (031) Select appropriate formula from Appendix B. At Any AFB, there were 26 man-days lost during the month of August. The mean base strength during this period was 2300. Compute the non-effectiveness rate.

a. 3.6/1000 POP/DAY.
b. 0.36/1000 POP/DAY.
c. 50.2/1000 POP/DAY.
d. 0.0502/1000 POP/DAY.

42. (031) At Prairie AFB, during the month of October, there were 32 cases of gonorrhea and two cases of syphilis. The average daily population was 1600. Calculate the incidence rate/1000/yr for venereal disease.

a. 21.25.
b. 212.5.
c. 240.0.
d. 255.

43. (032) What study method for conducting epidemiological investigations are you using when you observe, question, and study relative proportions of the population in order to detect cases of a disease?

a. Cross-sectional survey.
b. Prospective.
c. Retrospective.
d. Laboratory.

44. (033) Your *first* step in any epidemiological investigation should be to

a. test your hypothesis on what caused the problem.
b. draw up plans for the control of the situation.
c. establish the existence of the epidemic.
d. orient the epidemic to time, place, and person.

45. (034) Preparing the list of reportable diseases required by federal, state, and local laws and Air Force directives is the responsibility of

a. Environmental Health Services.
b. Patient Affairs.
c. the local health department.
d. the major command.

46. (034) The list of reportable communicable diseases should be updated as necessary to stay current; however, it must be updated at least

a. every 30 days.
b. every 3 months.
c. semiannually.
d. annually.

47. (035) Who advises the Infection Control Committee concerning disease trends?

a. Patient Affairs.
b. Medical Laboratory.
c. Environmental Health Service.
d. Bioenvironmental Engineering.

48. (036) Exogenous infections are those that

a. develop from within the patient.
b. result from pathogens being transferred from the hospital environment to a patient.
c. are transmitted solely by disease vectors.
d. develop from being exposed to excessive antibiotics.

49. (037) The *major* mission of the Hospital Infection Control Committee is to

a. provide policies for TB detection and control.
b. write SOPs and OIs concerning sanitation in the hospital.
c. isolate ineffective cases.
d. control and prevent nosocomial infections.

50. (038) Which of the following is *most* likely to be a hazardous food?

a. Beef jerky.
b. Tomatoes.
c. Tuna salad.
d. Peanut butter.

51. (039) Prevention of botulism is based upon

a. refrigeration of food items.
b. physical examination of all good handlers.
c. proper preparation of foods.
d. vaccination of herds.

52. (040) Elimination of which of the following would most likely prevent all foodborne illnesses?

a. Food handlers with infections.
b. Abuse of food handling procedures.
c. Commercial food processing.
d. Moist, high-protein foods with high acid content.

53. (041) How often should the Base Environmental Health Officer train hospital personnel in the proper procedures to follow during a foodborne illness outbreak investigation?

a. Monthly.
b. Bimonthly.
c. Semiannually.
d. Annually.

54. (041) In the event of a foodborne illness outbreak, Environmental Health Technicians should interview the patients and

a. conduct a sanitary inspection of the suspect facility as soon as possible.
b. notify the DBMS immediately after diagnosing the agent involved.
c. collect vomitus samples for laboratory examination.
d. report suspected food handlers to CDC.

55. (042) The food vehicle most likely causing a foodborne illness outbreak will become apparent when

a. specific attack rates are determined.
b. a sanitary inspection is completed.
c. an incubation period is calculated.
d. patients tell us which food made them ill.

56. (038) A source of information you would *not* normally consult as you prepared a foodhandler's training course is

a. US Department of Agriculture.
b. Food and Drug Administration.
c. Base commander's office.
d. Base film library.

57. (044) After the initial abreviated training program, each new foodhandler must attend a formal training course within how many days?

a. 30.
b. 45.
c. 90.
d. 120.

58. (044) Every food handler must receive refresher training

a. monthly.
b. quarterly.
c. semiannually.
d. annually.

59. (045) Schistosomiasis can be controlled by the elimination of

a. fleas.
b. flies.
c. snails.
d. mosquitos.

60. (045) You will frequently see outbreaks of which of the following diseases at child care centers?

a. Giardiasis and hepatitis A.
b. Giardiasis and schistosomiasis.
c. Typhoid fever and hepatitis B.
d. Schistosomiasis and paratyphoid fever.

61. (046) Project Gargle is a special Air Force program designed to monitor the incidence of

a. influenza.
b. streptococcal sore throat.
c. bacterial meningitis.
d. viral meningitis.

62. (047) Dried residues of suspended tuberculosis germs are known as

a. bronchial cilia.
b. droplet nuclei.
c. macrophages.
d. atypical mycobacteriums.

63. (047) After initial infection with tuberculosis bacilli, an individual develops tuberculin hypersensitivity within

a. 2-10 hours.
b. 2-10 days.
c. 2-10 weeks.
d. 2-10 months.

64. (048) Before an isoniazid (INH) patient leaves PCS or TDY, he or she should be stabilized on INH therapy for at least

a. 7 days.
b. 1 month.
c. 10 weeks.
d. 6 months.

65. (048) What is the recommended followup for persons *not* placed on isoniazid (INH) chemotherapy?

a. Rifampin.
b. Chest x-rays.
c. BCG vaccination.
d. Liver function tests.

66. (049) When is the annual TB report submitted to MAJCOM?

a. January.
b. March.
c. October.
d. December.

67. (050) Engaged in an effort to control respiratory disease, you can *best* maintain surveillance of a population through

a. biostatistics and disease reporting.
b. health education and disease reporting.
c. health education and isolation of all contacts.
d. biostatistics and chemoprophylactic treatment of all infectious persons.

68. (051) The complication of gonorrhea that exists when the gonoccocus invades the bloodstream is called gonococcal

a. ophthalmalia.
b. epididymis.
c. pharyngitis.
d. septicemia.

69. (052) For gonorrhea cases, the followup test of cure cultures must be taken from the infected site how many days following treatment?

a. 3-10.
b. 14-21.
c. 30-35.
d. 45-50.

70. (053) Once in the body, *Treponema pallidum* invades the bloodstream within a matter of

a. seconds.
b. minutes.
c. hours.
d. days.

71. (054) Patients treated for congenital syphilis with any antibiotics other than penicillin should be followed up with repeat

a. lumbar punctures.
b. darkfield examinations.
c. serologic tests.
d. Urinalysis.

72. (055) A relapsing infection that invades the nerve cells of its victims is

a. gonorrhea.
b. granuloma inguinale.
c. genital herpes.
d. postpartum fever.

73. (056) The vaginal yeast infection caused by the fungus *Candida albicans* is also known as

a. monilia infection.
b. *Condylomata lata*.
c. lymphgranuloma venereum.
d. granuloma inguinale.

74. (057) Which of the following types of hepatitis may be transmitted during intimate sexual contact?

a. Hepatitis A.
b. Hepatitis B.
c. Hepatitis non A, non B.
d. All of the above.

75. (058) Which of the following is *least* likely to help prevent transmission of social disease?

a. Vaginal contraceptive.
b. Oral contraceptive.
c. Condom.
d. Abstinence.

76. (059) The STD counsel/interview should be held after the diagnostic examination and prior to

a. dismissal.
b. evaluation.
c. treatment.
d. followup.

77. (060) In the STD Control Program, the physician does all of the following *except*

a. diagnostic evaluation.
b. prescribe medications.
c. administer treatment.
d. analyze smears.

78. (060) If results of an STD test on a sexual contact are positive, the individual must be

a. reprimanded.
b. re-tested.
c. interviewed.
d. re-treated.

79. (061) Which agency should you consult concerning the chronic and acute effects of pesticides?

a. Occupational and Environmental Health Laboratory.
b. Environmental Protection Agency.
c. Base Civil Engineer.
d. Epidemiological Division, Brooks AFB.

80. (062) Which of the following are examples of insects with gradual or incomplete metamorphosis?

a. Mosquitos.
b. Flies.
c. Fleas.
d. Lice.

81. (062) The body of an insect is divided into what three main regions?

a. Head, thorax, and legs.
b. Head, thorax, and abdomen.
c. Head, abdomen, and antennae.
d. Head, abdomen, and legs.

82. (063) An advantage of chemical control for adult mosquitos is that it provides

a. lack of contamination of the environment.
b. speed in obtaining positive results.
c. lack of mosquito resistance.
d. ability to do away with cultural control.

83. (064) Which of the following are characteristics of the rodenticide Warfarin?

a. Has low acute toxicity; acts as an anticoagulant.
b. Has high acute toxicity; affects the central nervous system.
c. Is extremely toxic; stops cellular respiration.
d. Has low toxicity; is readily absorbed through the skin.

84. (064) What is the mode of action of methyl bromide and hydrogen cyanide?

a. Contact poison.
b. Dermal poison.
c. Stomach poison.
d. Respiratory poison.

85. (065) Which mosquito usually breeds in and around human dwellings?

a. Mansonia.
b. Coquillettidia.
c. Toxorhynchites.
d. *Aedes aegypti.*

86. (065) Which mosquito larvae sub-family lie parallel to the water surface?

a. Mansonia.
b. Culicines.
c. Anophelines.
d. Psorphora.

87. (066) What is submitted from the ovitrap for identification of mosquito eggs?

a. Scum.
b. Inside walls.
c. Water.
d. Paddle.

88. (067) The trap index is the average number of

a. female mosquitos trapped per night.
b. mosquitos trapped per night.
c. female mosquitos trapped per month.
d. mosquitos trapped per month.

89. (068) All of the following are examples of biological control measures *except*

a. Toxorhynchites larvae.
b. *Gambusia affinis* minnow.
c. *Bacillus thuringiensis israeliensis.*
d. Mansonia larvae.

90. (068) Which of the following is an example of cultural control methods?

a. Dusting vegetation around the edges of ponds.
b. Release of pathogens in the environment to kill mosquito larvae.
c. Using a bio-degradable insecticide.
d. Filling low areas containing water.

91. (069) All of the following are diseases/conditions associated with lice *except*

a. relapsing fever.
b. typhus fever.
c. murine typhus.
d. pediculosis.

92. (069) The itch mite burrows and lives in the skin of man, causing a condition called

a. scabies.
b. vesiculation.
c. envenomization.
d. pediculosis.

93. (070) Which of the following diseases is transmitted by contact with the urine or feces of an infected rat or other animal?

a. Tularemia.
b. Leptospirosis.
c. Endemic typhus.
d. Trichinosis.

94. (070) Rodent control is *best* based on

a. chemical measures.
b. mechanical control.
c. fumigation.
d. environmental sanitation.

95. (071) The variableness of the clinical signs of rabies in animals depends on the

a. type of animal affected.
b. stage of the disease in the animal affected.
c. age of the animal affected.
d. size of spinal cord and brain of the affected animal.

96. (072) The preferred rabies vaccine since 1980 has been

a. human diploid cell vaccine.
b. duck embryo vaccine.
c. goat diploid cell vaccine.
d. chicken embryo vaccine.

97. (073) In the field, who establishes standards for water quality and inspects water points and sources?

a. AF Medical Department.
b. Field training officer.
c. Corps of Engineers.
d. Unit commander.

98. (073) When you are purifying water under ordinary field conditions, the chlorine residual required after 30 minutes of contact time is

a. 1 ppm.
b. 2 ppm.
c. 5 ppm.
d. 10 ppm.

99. (074) Acid food and beverages should *never* be stored in galvanized iron cans because doing so may produce what type of toxic poisoning in the consumers?

a. Mercury.
b. Zinc.
c. Lead.
d. Iron.

100. (074) In the field, how often are food service personnel inspected for signs of illness?

a. Every other shift.
b. Daily.
c. Once a week.
d. When an outbreak occurs.

101. (075) You may disinfect fruit and vegetables by soaking them in a

a. 100 ppm chlorine solution for 30 minutes.
b. 150 ppm chlorine solution for 20 minutes.
c. 200 ppm chlorine solution for 15 minutes.
d. 200 ppm chlorine solution for 30 minutes.

102. (076) Latrines must be located at least how far from food facilities?

a. 50 feet.
b. 100 feet.
c. 200 feet.
d. 300 feet.

103. (076) How many latrines should be constructed for each 100 men?

a. 5.
b. 8.
c. 10.
d. 15.

104. (076) When the soil is hard, rocky, or frozen, which type of human waste disposal device is recommended?

a. Burn-out latrine.
b. Straddle trench.
c. Deep pit latrine.
d. Cat-hole latrine.

105. (077) Which of the following heat disorders is a medical emergency and requires immediate medical treatment?

a. Heat exhaustion.
b. Heat syncope.
c. Heat cramps.
d. Heatstroke.

106. (078) A good prevention measure for cold injuries is to

a. wear many layers of clothes.
b. consume alcohol.
c. eat small meals.
d. limit exercise of extremities.

END OF EXERCISE

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MAIL TO: ECI, GUNTER AFS AL 36118-5643

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012. **PRINCIPAL PURPOSE:** To provide student assistance as requested by individual students. **ROUTINE USES:** This form is shipped with ECI course package, and used by the student, as needed, to place an inquiry with ECI. **DISCLOSURE:** Voluntary. The information requested on this form is needed for expeditious handling of the student's inquiry. Failure to provide all information would result in slower action or inability to provide assistance to the student.

I. CORRECTED OR LATEST ENROLLMENT DATA

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CDC 90850

ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

Volume 2

Occupational Medicine

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Preface

THIS SECOND volume of your CDC 90850 was written to describe for you some of the many facets of occupational medicine. In this text we discuss the various toxic materials used in Air Force industrial workplaces and how to protect the workers from these hazards.

Chapter 1 is about man, medicine, and work and how they affect one another. In it you will read about the types of industrial operations you may find at your base, the hazards they produce, and how to control them.

Chapter 2 covers the Air Force occupational health program. In Chapter 3 you will study the purpose for respiratory protection, how to conduct the respiratory protection program, and how various types of respirators work. Chapter 4 discusses hearing conservation. In it you will find the information you will need in order to effectively monitor this program at your installation.

For easy reference, Appendix A, listing occupational health education programs, and Appendix B, listing ear protective devices, are provided. Use them when working many of your occupational health education programs.

A glossary of terms used in this text is included at the end of this volume.

Code numbers appearing on figures are for preparing agency identification only.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

This volume is valued at 21 hours (7 points).

Material in this volume is technically accurate, adequate, and current as of October 1984.

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CHAPTER 1

Man, Medicine, and Work

THE WORKPLACE can be a hazardous environment. This fact has been recognized for a long time. However, only recently have we come to recognize how hazardous the environment really can be. The number of potential threats to man's health and safety have multiplied rapidly. Hardly a day goes by when you can't open a newspaper and find some new threat to human health and safety that began within industrial shops. With new technology being developed as quickly as it is, you should not expect this situation to improve. It is likely to get even worse. Who knows what new chemical will be introduced tomorrow that has long-range, serious, chronic effects upon those who come in contact with it.

Let's look at those industrial operations that produce the hazards, at how we try to control the hazard and protect the worker, and lastly, at health education. To begin our study of occupational medicine, we need to discuss occupational toxicology.

1-1. Occupational Toxicology

The study of occupational toxicology involves the study of agents that are found in the industrial environment (fig. 1-1) which are potentially harmful to the function of the human system. Many substances have been known to be toxic for hundreds of years; for example, lead and mercury. Other substances have only recently been identified as toxic; for example, asbestos, coke gases, and vinyl chloride. Many substances have been identified as potentially toxic although no cause-and-effect relationship has yet been determined. And with the rate of entry of new chemicals into the industrial environment, it is likely that harmful effects exist for many chemicals that have not been studied at all.

200. State the classifications, routes of entry, and physiological effects of toxic materials and industrial hazards.

Types of Industrial Hazards. The hazards that the worker may encounter in the work environment can be classified into three major groupings: chemical, physical, and biological hazards. The first grouping includes the chemical hazards that are a result of a chemical action on the human system.

Chemical hazards. Chemical hazards are chemicals that pose a physiological hazard (inhalation or contact) to the worker. Some examples of chemical hazards are acids, solvents, lubricating oils, and carbons. One of the main occupational illness problems resulting from exposure to chemical hazards is contact dermatitis.

Physical hazards. The effect of physical hazards on the worker may be twofold. Certain physical hazards may produce damage to the health of the worker. Also, the worker may receive traumatic injury as a result of exposure to a physical hazard. However, the traumatic injury may be secondary to a chemical hazard or a physical hazard that exists in the work environment. For example, exposure to many of the aliphatic halogenated hydrocarbons can result in a disorientation of the worker, thus making the worker subject to potential traumatic injury. This situation may occur even though the exposure level of the toxic substance is insufficient to cause a chronic or acute toxic reaction in the worker. Noise, vibration, ionizing and nonionizing radiation, and thermal extremes are examples of physical hazards.

Noise. Unprotected exposures to high levels of noise can have various effects on the worker. First, the worker who is exposed to a high-level noise for a short period of time can exhibit a temporary hearing threshold shift. This hearing threshold shift is a loss in hearing that can be recovered within a short time after removal of the noise source. In general, most of this recovery occurs within 1 to 2 hours of exposure, with complete recovery occurring in approximately 14 to 16 hours. If the worker is continually exposed to excessive noise for a long period of time, the temporary hearing threshold shift can become permanent.

Another effect of excessive noise levels is interference with communication between workers. This interference with communication can be an annoyance to the worker and may result in a lowering of the efficiency of the operation. There also exists the possibility of traumatic injury because of this loss of communication.

The temporary hearing loss exhibited when exposed to excessive noise is in itself a protective mechanism. It can serve as a warning to the worker who is temporarily exposed that unless something is done a more permanent hearing loss may be incurred. When more permanent hearing loss begins to occur, it can usually be diagnosed in the 3000–6000-Hz frequency range (high-frequency

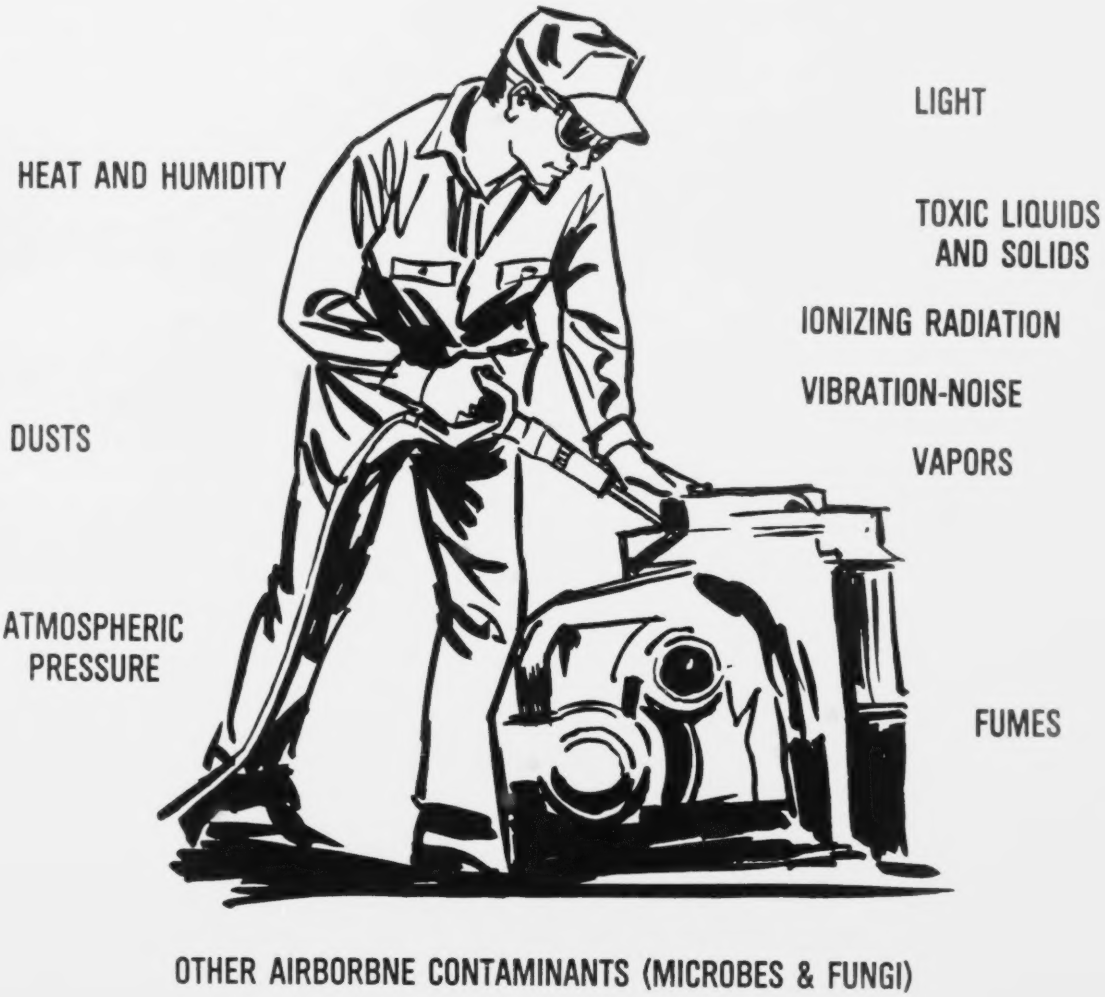

Figure 1–1. Environmental factors influencing man at work.

sound). Periodic audiometric tests can identify threshold shifts in this frequency range, thus providing for corrective action prior to hearing loss that might affect the worker's ability to understand voice communication (2000–3000 Hz).

Vibration. Vibration is often closely associated with noise. One of the reasons for this close association is generally if a vibration is present, a noise is also present. However, the noise that is present may not be at a level that can cause damage to the worker's hearing, while the vibration may be serious enough to merit concern.

The effect of vibration on the human body is not totally understood. Research has only begun to indicate where problems might exist. Initial research indicates that whole-body vibration increases the physiological activity of the heart and respiration. The results have also shown that there is an inhibition of tendon reflexes as a result of vibration. There seems to be reduced ability on the part of the worker to perform complex tasks, and indications of potential damage to other systems of the body also exist.

As with noise, the human body can withstand short-term vibration even though this vibration might be extreme. In addition, the dangers of vibration are related to certain frequencies that are resonant with various parts of the body. Vibration outside these frequencies is not nearly so dangerous as vibration that results in resonance.

Ionizing and nonionizing radiation. Ionizing and nonionizing radiations are becoming increasingly prevalent in the industrial work environment. Ionizing radiation results from electromagnetic radiation with energy sufficient to cause the loss of an electron from the matter with which it interacts. Nonionizing radiation is caused by rays from the electromagnetic spectrum which do *not* have energy sufficient to cause the loss of an electron. Ionizing

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radiation includes X-, gamma, alpha, beta, and neutron rays. Nonionizing radiation is caused by ultraviolet, infrared, laser, and microwave rays from the electromagnetic spectrum.

The effects of nonionizing radiation on the human are not well documented. However, some of the major effects that have been identified include damage to the eye and its ability to function, damage to the reproductive system, and burns of the skin. Ionizing radiation can produce skin burns as well as deep tissue burns. Ionizing radiation can also produce chronic effects on the human system. For example, ionizing radiation has certain carcinogenic and genetic damaging properties that can affect the long-term health of the exposed individual and potentially his or her children. Ionizing radiation can occur as both an external and an internal hazard. External exposure can occur as a result of unprotected proximity to gamma rays or X-rays. Internal exposure results from inspired radioactive material that can cause tissue damage in the lungs and transmission of damage throughout the human system by way of the blood stream. Additionally, radioactive material may also be ingested and settle in the critical organs (i.e., kidney, thyroid, etc.). You will read more about the effects of ingested radioactive material in Volume 5, *Medical Readiness*.

The body has very little protection against radiation. The skin acts as a protective mechanism for small doses of both ionizing and nonionizing radiation. The normal phagocytic action that occurs in the lungs for respirable dust is not nearly so effective a protective mechanism for radioactive materials that are inspired as it is for other respirable dusts.

Thermal extremes. Workers may be exposed to thermal hazards involving extreme heat, extreme cold, or rapid changes in temperature. The great majority of exposures involve workers in high-temperature areas. However, those exposures related to cold and rapid change in temperature can also exist.

There are various effects of high temperature on the worker as well as a number of factors that affect the individual's response to exposure to high temperatures. Among the important factors are the age of the individual, the surface-area-to weight ratio of the individual, and the acclimatization that the individual has attained. Older workers have a decreased ability to withstand high temperatures while performing work. As an individual becomes more obese, the ability to withstand extreme temperatures is also lowered. Individuals who have had a chance to become acclimatized to the heat will be more effective when working in a hot area. One other factor that affects individuals is the amount of physical activity that they are required to perform while subjected to the hot environment. As the physical activity increases, the time that a given temperature can be tolerated without adverse effect decreases.

There are certain physiological changes in the body that result from exposure to extreme heat. The first of these is the loss of salt that occurs because of perspiration. In addition to this loss of salt, a loss of body water and dehydration occur. The sweat glands may cease to function after prolonged exposure to high temperature. Also, because of the dilation of blood vessels near the surface of the skin, a pooling of blood in the extremities can occur. These physiological changes in the body can result in various heat illnesses such as (heat cramps, heat exhaustion, heat stroke, and skin rashes. (These were covered in Volume 1, *Field Sanitation*.

Exposures to extreme cold can result in frostbite occurring in exposed areas of the body. In addition, long-term exposure to cold temperatures can lower the core temperature of the body, thus presenting acute danger to human life.

The human body can regulate its internal body temperature within narrow limits by perspiration and dilation and constriction of the blood vessels. The variation in blood vessel size occurs to cause blood to flow to the surface for cooling in the case of high temperature and to restrict flow in the case of low temperature. In addition, after exposure to high temperatures, the worker can become acclimatized, thus allowing the body to withstand hard work at high temperatures with less chance of adverse effects. The muscle movement or shivering that occurs in cold temperatures is a reaction of the body to attempt to generate heat within the body tissue.

Biological hazards. Biological hazards consist of exposure to bacteria, viruses, and parasites. This exposure can be as a direct result of the work being performed or as a result of unhealthy conditions that exist in the work environment. The obvious example of exposure as a result of the work being performed is the worker in the hospital who must, by requirement of this job, come in contact with various communicable diseases. Exposure in the work environment can result from unsanitary conditions in rest rooms, eating areas, and locker rooms. The obvious result of biological exposures is the illness of the worker and the transmission of the disease to other associated workers.

The body has an internal mechanism that creates white blood cells to fight infections. In addition, the individual can be protected from many diseases by immunization, where antibodies are produced that protect against possible future infection of a particular disease. Since immunization is disease specific, it is not a cure-all protective device.

Toxicology. As was pointed out in your first CDC volume, *Control of Communicable Diseases*, the human system exists in a delicate balance. As the human body functions within the environment, it is constantly being assaulted with many foreign substances and physical phenomena. This is especially the case when the human is working within the industrial environment where many of the foreign substances and physical phenomena exist in highly concentrated forms because of the necessity of the work that is being performed. Some of these substances and phenomena present a potential danger to the human system; many are harmless; and a large category of substances and phenomena exist for which the results are not yet known.

You have already studied some of the major defense mechanisms that protect the human system. These defensive mechanisms are useful when the concentration of potentially hazardous materials is relatively low. However, in the industrial environment where high concentrations of such materials may exist, the defense mechanisms of the human system often fail to provide adequate protection of the body. Thus, a hazardous exposure exists for the worker.

Type of substance. You should consider certain major factors when attempting to determine the hazardous effect of a material or phenomenon. Some materials are inherently more dangerous than others. Many substances that exist in the industrial environment fall in the category of materials for which either no potential hazard has been proved or no hazard exists. A previous discussion pointed out that for those materials and phenomena judged to be hazardous there exist varying levels of effect on the human system. For example, though carbon tetrachloride and asbestos are both toxic materials, one would not likely consider carbon tetrachloride in the same classification as asbestos in terms of toxicity.

Route of entry. The next major consideration to determine the hazardous effect of a material or phenomenon is the route of entry of the hazardous material into the human system. The route by which the hazardous material enters the human body can have a relationship to the reaction of the body to the material. Certainly those materials that enter the body through the respiratory system are generally more difficult to handle and present a significantly greater potential danger to the worker than those materials that are hazardous when touched by the unprotected skin.

Amount of exposure. The amount of exposure or concentration of the material or phenomenon is important. Too much of anything can be hazardous. For example, carbon monoxide is not hazardous in low amounts; however, it is certainly likely that physical harm will occur to an individual who is exposed to high levels (e.g., headaches with confusion at levels less than 500 parts per million (ppm) compared to deep coma, shock, and respiratory failure at levels of 1000 ppm). A general rule in terms of the amount of exposure is that the more toxic the material or phenomenon, the less exposure the human system can tolerate.

Duration of exposure. The duration of the exposure is also important. Again using the carbon monoxide problem, exposure to levels less than 400 ppm for 15 minutes is not likely to cause a problem, while exposure to these same levels for 8 hours may result in death. Quite often the duration of exposure that can be tolerated by the human system is not known. Presently, much controversy surrounds the hazard potential of a short exposure to asbestos or vinyl chloride in the air.

Individual differences. With deference to the Declaration of Independence, not all men (and women) are created equal, particularly in terms of their ability to withstand exposure to hazardous materials. Individuals often respond differently as a result of their age, sex, and general overall health. It has been shown that as an individual ages his or her ability to withstand long exposures to high temperatures lessens. The same result can be expected for individuals who are in poor physical condition.

Toxicity. How does one determine whether a substance is toxic or not? Obviously, it is not desirable for this determination to wait until proven harmful effects to the human system have been exhibited by a number of individuals who have been exposed to the substance. As a result, the determination of toxicity is dependent upon animal studies. In these studies certain animals—quite often rabbits, rats, or primates—are exposed to the substances under study; and the dose-response relationship is determined. In most preliminary studies the response to be identified is cessation of life in the test animal. Other studies may be conducted for the pathological changes in the major organs, such as the liver and kidney, of such animals. Two terms are used by toxicologists to identify the dose-response results obtained from a study. The first of these is the dose which will produce death in 50 percent of the dose animals. This value, the lethal dose for 50 percent of the animals, is abbreviated in the following manner: LD_{50}. The value is the best estimate that can be made based upon the results of the study, and it is obtained statistically. The second major term is used to designate the concentration in air that may be expected to kill 50 percent of the animals exposed for a specified length of time. This statistical estimate, lethal concentration 50, is abbreviated as LC_{50}.

The results of such studies provide a basis for determining the relative toxicity of a given material when compared to other materials. Table 1-1 is an overview of the relative toxicity classes as found in toxicological study reports. The nomenclature has been developed to prevent confusion concerning the use of terms such as toxic, nontoxic, and mildly toxic. The table presented assumes the subject of study to be rats. The dose response for a different subject can differ from that presented in the table.

Exposure routes and protective mechanisms. There are at least three routes by which industrial substances can gain entry into the worker's body. In order of importance they are *inhalation*, *skin contact*, and *ingestion*. It is obvious that some substances may have multiple routes of entry. These will be noted in the appropriate section.

Inhalation. A major area of concern for you is with those materials that may enter the body through the respiratory tract. Much of the bioenvironmental engineering specialist's work, your counterpart, involves determining the concentration of hazardous materials that exist in the air of the work environment. This emphasis of concern is justified both in terms of the hazardous effect of respirable toxic substances on the human system and the pervasive nature of toxic substances that become suspended in the air.

The adult human lung has an enormous gas-tissue interface (90 square meters total surface, 70 square meters alveolar surface). This large surface, together with the blood capillary network surface of 140 square meters, with its continuous blood flow, makes possible an extremely rapid rate of absorption of many substances from the air in the alveolar portion of the lungs into the blood stream.

The dose rate for respirable toxic substances is difficult to determine. The respiration rate and depth between individuals varies. This is particularly the case when, in a given workplace, some individuals remain sedentary and others are required to do more physical labor, thus increasing the respiration rate and depth. In addition, the concentrations of pollutants in the air may vary at different locations of the work environment. Concentrations can also build up and reach peaks based upon production cycles that occur in the work environment.

Certain protective mechanisms are present in the

TABLE I-1

TOXICITY CLASSES FOR LC$_{50}$/LD$_{50}$ STUDIES

Toxicity Rating	Descriptive Term	LD$_{50}$-Wt/kg Single Oral Dose Rats	4 hr. Inhalation LC$_{50}$--PPM Rats
1	Extremely toxic	1 mg or less	< 10
2	Highly toxic	1-50 mg	10-100
3	Moderately toxic	50-5000 mg	100-1,000
4	Slightly toxic	0.5-5 g	1,000-1-,000
5	Practically nontoxic	5-15 g	10,000-100,000
6	Relatively harmless	15 g or more	> 100,000

respiratory system that provide a first line of defense against toxic materials that may be inspired. Soluble gases are absorbed in the moist mucous membrane of the upper respiratory tract, thus limiting their effect to that of an irritant in this area of the respiratory system. Particulate matter is filtered out of the respiratory system at various stages. The nasal structure and turbulent air flow that results cause the settling of large particles that are then captured by the mucous membrane of the nose. The cilia, small hair-like filaments in the nose and upper respiratory tract, serve to help the mucus filter particulate matter from incoming air. The large number of branches that occur in the bronchi also act to filter out large particulate matter. Usually, only the smallest particles will reach the alveoli of the lung. These particles are of a diameter of less that 10 micrometers. Once these particles have reached the lowest level of the lungs, phagocytic cells (macrophages) act to entrap the particles to slow their potential harmful action in the body. Some particles are filtered out of the system through the lymphatic system.

Skin contact. The most common route of exposure that exists in the industrial environment is the skin. Upon contact of a substance with the skin, four actions are possible: (1) the skin and its associated film of lipid can act as an effective barrier against penetration, injury, or other forms of disturbance; (2) the substance can react with the skin surface and cause primary irritation (dermatitis); (3) the substance can penetrate the skin and conjugate with tissue protein, resulting in skin sensitization; and (4) the substance can penetrate the skin, enter the blood stream, and act as a potential systemic poison.

The skin has certain protective mechanisms that can act to inhibit exposure to the toxic material through this route. The first mechanism is the multiple layers of skin that exist, thus providing for a less permeable surface. The sweat glands produce perspiration that will dilute the toxic substance that comes in contact with the skin. The lipid film that is present on the skin's surface as a result of the action of the sebaceous glands also provides a protective layer that must be penetrated. A breakdown of any of these protective mechanisms will cause a more serious hazard exposure to exist. Thus, if the oily film is removed by cutting oils or if a break in the skin occurs through a wound (i.e., abrasion, laceration, or cut, etc.), the danger to the worker of exposure through the cutaneous route is much higher. Even with all of its protective mechanisms, some toxic materials are readily absorbed into the skin. Serious and even fatal poisonings have occurred from brief exposures of confined areas of the skin to highly toxic substances such as parathion and related organic phosphates, the organometallics, the alkyl leads and tins, and aniline, phenol, and hydrocyanic acid.

Ingestion. Health hazards to the worker from ingestion of industrial substances in comparison with those from the inhalation and skin contact routes are generally of such a low order as to warrant only limited discussion.

First, the number of substances that can be ingested are fewer since it is virtually impossible to ingest a vapor or gas. Second, the frequency and degree of contact are very limited; mouth contact with substances on hands, in food, in drink, and on cigarettes is far less frequent, of shorter duration, and lesser in amount during the work shift than that with other routes of entry.

Third, and most important, toxicity by mouth is generally of a lower order than that by inhalation. Reasons for this include: (1) poor absorption into the blood stream; (2) subjection to relatively high acidity (pH 1 to 2) in passing through the stomach; and (3) subjection to the alkaline medium of the pancreatic juice on passing through the small intestine. Both these latter may act to reduce toxic organic substances through hydrolysis to less toxic substances. Moreover, the pancreatic enzymes begin to convert (or metabolize) some substances to less toxic subunits well before the parent substance is absorbed.

It is worth noting that portions of inhaled particles that lodge in the upper parts of the respiratory tract during inhalation are swept up the tract by ciliary action and are subsequently swallowed.

Although the foregoing statements on reduced toxicity by ingestion in comparison with that by inhalation are true in general, there are obviously striking exceptions. Notable among the exceptions are those highly toxic elements with slowly cumulative action such as arsenic, cadmium, lead, and mercury. Recognition of the potential of such elements to add to the body's burden through ingestion has led to prohibiting eating, drinking, and smoking in areas where there are such exposures.

Physiological classification of toxic materials in air. Toxic materials in air produce many physiological responses in the human system. The following discussion will present a system for classifying toxic materials in terms of the physiological response obtained. This system, though generally accepted, is somewhat arbitrary since the type of physiological response depends on the dose/concentration of the toxic material.

Irritants. An irritant can cause inflammation of the mucous membrane of the respiratory tract. Toxic materials can be either primary irritants, where inflammation is the major physiological reaction (for example, acids), or the toxic materials may be secondary irritants. Secondary irritants, along with causing inflammation of the respiratory tract, also result in more serious toxic action to the human system. Examples of secondary irritants include hydrogen sulfide and many of the aromatic hydrocarbons.

Asphyxiants. Asphyxiants deprive the cells of the body of their oxygen supply. Simple asphyxiants are inert elements that in sufficient quantity exclude oxygen from the body. Examples of simple asphyxiants include nitrogen, carbon dioxide, and helium. Chemical asphyxiants act in the body to limit the use or availability of an adequate oxygen supply. Examples of chemical asphyxiants are carbon monoxide and cyanides. The action of carbon monoxide in attaching to the hemoglobin of the body, thus disabling the transport of oxygen, is well known.

Anesthetics. Anesthetics act to depress the central nervous system. The most common example of anesthetic is alcohol. Other anesthetics include acetylene hydrocarbons, ethyl ether, paraffin hydrocarbons, and aliphatic ketones.

Hepatotoxic agents. Hepatotoxic agents damage the normal functioning of the liver. Examples of hepatotoxic agents are carbon tetrachloride, tetrachloroethane, nitrosamines, and some compounds of plant origin.

Nephrotoxic agents. Nephrotoxic agents result in damage to the functioning of the kidney. Examples of nephrotoxic agents include some halogenated hydrocarbons and uranium.

Neurotoxic agents. Neurotoxic agents produce damage to the nervous system. Examples of neurotoxic agents include organometallic compounds such as methyl mercury, tetraethyl lead, and carbon disulfide.

Blood damaging agents. Blood damaging agents break down the red blood cells or chemically affect the hemoglobin in the blood. Examples of blood damaging agents include benzene, arsine, and aniline.

Lung damaging agents. Lung damaging agents produce their effect on the pulmonary tissue. This effect is that which occurs beyond the irritant action that certain acids and other materials produce. Examples of lung damaging agents are silica, asbestos, coal dust, and organic dusts.

Physical classification of toxic materials. There are four major categories for the physical classification of toxic materials. These classifications are gases and vapors, particulate matter, liquids, and solids. The latter two, liquids and solids, though a concern of the industrial hygienist, do not pose nearly the problem that is posed by gases and vapors and particulate matter.

A gas is defined as a material that exists in natural form as a gas at 25 °C and 760 mmHg (standard temperature and pressure). On the other hand, a vapor is the gaseous stage of a material that is a liquid or solid in its natural state at 25 °C and 760 mmHg.

The next physical classification of toxic materials is particulate matter. Particulate matter is generally in the form of an aerosol; i.e., a dispersion of solid or liquid particles in a gas. There are five major types of aerosols that can exist. These are as follows:

- Smoke—Particles that result from incomplete combustion.
- Fog—Visible aerosol consisting of condensed liquid.
- Mist—A dispersion of liquid particles, many of which are individually visible.
- Fume—Solid particles generated by condensation from a gaseous state, generally as a result of the volatilization of molten metal.
- Dust—Particles that result from a mechanical action on a solid.

The physical classification of toxic materials is important, both in the methods that are used to evaluate the level of contaminants in the atmosphere and in the control methods that are available to remove the contaminants. Gases and vapors provide a different problem than that which is faced when attempting to remove particulate matter from the air.

Exercises (200):

1. Describe how the effect of physical hazards on the worker may be twofold.

2. What are the effects of noise on the worker?

3. If noise is present, what other physical agent may also be present and produce a hazard?

4. State the effects of nonionizing radiation on the human body.

5. What are the effects of unprotected ionizing radiation exposures?

6. What are some of the factors which affect how a worker will respond to exposures to high temperatures?

7. How does the human body regulate its internal body temperature?

8. How can you protect workers against biological hazards?

9. Cite five considerations in attempting to determine the hazardous effect of a material.

10. What is meant by LD_{50} and LC_{50} dose responses?

11. What is the most common route of exposure of toxic substances on the body?

12. State the effect asphyxiants have on the body.

13. Cite some examples of anesthetics and describe their effect.

14. What are neurotoxic agents?

15. Cite the four major physical classification groups of toxic materials.

1-2. Industrial Operations and Related Hazards

Throughout this section on industrial operations, we will attempt to identify those aspects of the industrial operation commonly encountered on most Air Force bases. This section is not intended to make you an "expert" on all aspects of the occupational environment; rather, the intent is to introduce you to those operations and provide guidance for further research.

201. Identify the potential biological, chemical, or physical hazards and common symptoms of exposure for various Air Force industrial operations.

Chemicals Used in Air Force Operations. Raw materials from many sources are converted by the chemical industry into substances used for production of other products and for metal cleaning (degreasing). The Air Force uses thousands of gallons of solvents annually, mainly for cleaning and degreasing operations. We will discuss the main categories of these solvents, along with a brief description of the adverse effects of each category and some examples.

Halogenated hydrocarbons. The halogenated hydrocarbons are among the most widely used industrial chemicals. In this group is a wide variety of selection of solvents suited to a particular process requirement. This is why they account for the largest volume of use as compared to the other categories of solvents.

The toxicologic effects of halogenated hydrocarbons vary from one compound to another, but, generally, most cause CNS (central nervous system) depression. Also common is the defatting of the skin which may lead to dermatitis. Inhalation of high concentrations of vapor may cause liver or kidney damage, but it should be noted that while some compounds may have no effect, others may affect only one of these two organs, and still others may affect both. Medical surveillance of personnel exposed to halogenated hydrocarbons should include urinalysis to check for a dysfunction in the kidney.

Some of the halogenated hydrocarbons used in the Air Force are: fluorocarbons (freons), methyl chloride, methylene chloride, tetrachloroethane, trichloroethane, and trichloroethylene.

Aliphatic hydrocarbons. Aliphatic hydrocarbons are derived from petroleum by the cracking, distillation, and fractionation of crude oil. They are used principally as fuels, refrigerants, propellants, dry cleaning agents, lubricants, solvents, and chemical intermediates. Aliphatic hydrocarbons are asphyxiants and CNS depressants. Some members of this group cause the displacement of oxygen and fires and explosions. Other members cause narcosis. Another common effect is irritation of the skin and mucous membranes of the upper respiratory tract. Repeated and prolonged skin contact may result in dermatitis, due to the defatting of skin. Direct contact of liquid hydrocarbons with lung tissue (aspiration) will result in chemical pneumonitis, pulmonary edema, and hemorrhage.

Some of the aliphatic hydrocarbons used in the Air Force are: acetylene, ethane, gasoline, kerosene (jet fuel), naptha, and mineral spirits (stoddard solvent).

Aromatic hydrocarbons. Aromatic hydrocarbons cause CNS depression, and depending on the compound, hepatic, renal, or bone marrow disorders. The vapor is absorbed through the lungs, and liquid may be absorbed through the skin. Repeated and prolonged skin contact may cause defatting of the skin which leads to dermatitis. Some of the aromatic hydrocarbons used in the air force are benzene (limited use), styrene, tolene, and xylene.

Phenols and phenolic compounds. Phenolic compounds are widely distributed in industry and some are used in pharmaceuticals because of their disinfectant action. These materials generally enter the body by inhalation and percutaneous absorption. The toxicity varies, but some are highly irritating to the skin, mucous membranes of the upper respiratory tract, and eyes. Some are corrosive for all tissue; creosote, a complex mixture of phenolic and aromatic compounds, may cause skin cancer. Systemic effects usually involve the central nervous or cardiovascular systems or both; this may be accompanied by renal and hepatic damage.

Appropriate engineering controls and personal protective devices should be used to prevent absorption by either the respiratory or percutaneous route, and eye protection should be utilized where necessary. Some of the phenols and phenolic compounds used in the Air Force are creosote, hydroquinone, and phenol.

Acids and alkalies. This group covers a wide range of substances, many which are very important to industry. These compounds have a primary irritant effect, the degree determined by each specific type of substance. In addition to burns (or dermatitis), bronchopneumonia, pulmonary edema, and kidney damage have accompanied exposures to these compounds. Examples of acids and alkaline compounds include acetic acid, sulfuric acid, potassium hydroxide (alkali-electrolyte for the nickel cadmium batteries), and sodium hydroxide (alkali used in paint strippers and aircraft cleaning compound).

Organophosphates. The organophosphate insecticides are characterized by the similarity of their mechanism of toxic action. They differ widely, however, in inherent toxicity and, to some extent, in rate of absorption and excretion.

The organophosphates act as irreversible inhibitors of the enzyme cholinesterase, thereby allowing the accumulation of acetylcholine at the nerve endings. They are rapidly absorbed into the body by ingestion, through the intact skin, including the eye (even more efficiently through cuts, abrasions, areas of dermatitis, etc.), and by inhalation. Additionally, you should note that the worker may continue to be exposed long after pesticide application through contaminated hair, shoes, and clothing.

A mild organophosphate poisoning causes symptoms of headache, fatigue, dizziness, blurred vision, excessive sweating, nausea and vomiting, stomach cramps, diarrhea, and salivation. These symptoms are similar to those of many diseases not related to pesticide exposure such as influenza, heat stroke, heat exhaustion, and gastroenteritis. Moderately severe organophosphate poisoning causes all of the symptoms found in mild poisoning, but in addition, the patient is unable to walk, often complains of chest discomfort and tightness, exhibits marked miosis (constriction of the pupils), and exhibits muscle twitching. These symptoms might be reasonably mistaken for such conditions as pneumonia, myocardial infarction, and encephalitis. A severe organophosphate poisoning may result in rapid onset of unconsciousness and local or generalized seizures.

Ketones. In industrial operations, ketones are used in many ways. Their use as solvents accounts for most of the ketones produced. They may also be found in many items such as synthetic varnishes, coatings, and adhesives.

Industrial exposure to the common ketones is most likely to be through inhalation of vapors or through contact with liquids. Prolonged exposure is usually precluded by the intense irritation of the eyes and respiratory tract.

Some of the ketone compounds used in the Air Force are acetone, methyl ethyl ketone, and methyl isobutyl ketone.

Air Force Industrial Operations. The industrial operations we will discuss in this section are metal degreasing/cleaning; fuel handling/tank cleaning; welding; battery shops; corrosion control; structural repair; aerospace ground equipment; nondestructive inspection; and lastly, the medical facility you work in. Obviously, these are not the only industrial operations you have at your base. We have tried, however, to address the major industrial shops found at most Air Force bases.

Metal degreasing/cleaning. The Air Force uses thousands of gallons of solvent each year. There are three basic types of metal degreasing operations:

a. Cleaning small areas with a rag soaked with a solvent.

b. Spraying solvents on a large piece of equipment, such as cleaning aircraft.

c. Dipping a piece of equipment into a tank filled with solvent.

The hazards produced by this operation are dependant upon the type of chemical utilized for the cleaning. Some common results produced are dermatitis, mucous membrane irritation, central nervous system depression, liver and kidney damage, and eye irritation.

Fuel handling/tank cleaning. In this operation personnel accomplish hazardous tasks involving re/defueling, fuel cell repair/cleaning, and tank cleaning. Each of the related hazards are listed below by operation.

a. Re/defueling - splashing of fuel, fire and expolsion, dermatitis, tetraethyl lead, and noise (because this operation is frequently done on the flight line).

b. Fuel cell repair/cleaning and tank cleaning - fire and explosion, confined space entry, anoxia, and dermatitis.

Welding. The welding shop is a very important asset in fabricating much of the equipment used by the Air Force. There are several types of welding (e.g., oxyacetylene, electric arc, heli-arc, plasma torch, and metalizer), each of which produces a slightly different hazard. Some of the general hazards associated with welding are exposures to metal fumes; fluxes (a substance used to aid in fusing metals; some fluxes contain fluoride); various gases which may cause asphxiation in high concentrations; eye and skin irritation from sparks and burns; fire and explosion hazards because of the gases used; and radiation exposure (ultraviolet, laser, and infrared) which causes a sunburn effect to exposed skin. Additionally, remember that laser welding can damage the rods and the cones in the eyes.

Battery shops. The operation in the battery shop involves checking discharge rates and repairing batteries. There are two basic types of batteries used: acid base (sulfuric acid is the electrolyte) and caustic base (with potassium hydroxide as an electrolyte). Explosion is a primary hazard with use of the lead-acid batteries. The acid mist which may be released when these batteries are charging may be an additional hazard. Think of what acid on skin does and then imagine the effect of breathing in acid mists. Chemical burns may be a hazard because of handling the base batteries as well as the electrical shock produced when the batteries are charging.

Corrosion control. The paint pigments, solvent carriers, and any isocyanates (polyurethane paints) are the main toxic materials you will be concerned with in corrosion control shops. To the worker, these cause such hazards as dermatitis, inhalation hazards (isocyanates), central nervous system depression, liver and kidney damage, and eye irritation.

Structural repair. Structural repair includes electroplating operations, fiber glass work, machine shops, and sheet metal shops. In the fiberglass shop the resins, adhesives, vapor from curing the fiberglass, asbestos, etc., cause inhalation hazards (toxic vapors and fiberglass/asbestos dust from sanding) and, of course, contact dermatitis (as well as eye hazards) from working with these materials. In electroplating operations the exposure is primarily inhalation hazards, and in the machine shop and sheet metal shop, noise and lubricating oils are the primary hazards (also eye hazards from metal pieces).

Aerospace Ground Equipment (AGE). Powered AGE consists of an internal combustion engine used to provide heat, supplemental lighting and aircraft engine starting on the flight line and in many maintenance areas. The primary hazards caused by this equipment are hazardous noise levels, inhalation of exhaust emissions, and dermatitis-producing carbons and solvents.

Nondestructive inspection (NDI). The NDI shop inspects aircraft and metal parts using several processes. Small parts are cleaned if necessary using a solvent such as PD 680. They are then dipped into a series of tanks containing a penetrant dye, emulsifier, and a water rinse. The part is heated and dried by a machine and then inspected using an ultraviolet (UV) light source to detect cracks or hair-line fractures that could not be seen otherwise. Large parts or an entire aircraft can be examined using industrial X-ray exposures (ionizing radiation). Primary hazards of this operation are ionizing (X-ray) and nonionizing radiation and PD 680 (causes contact dermatitis).

Medical facilities. Recently, the director of NIOSH stated, "Hospital workers are exposed to more chemicals than any other worker group but do not have the protections available to workers in other industries. Also, hospital workers have twice the rate of job-related injuries and they are exposed to 300 problem-causing chemicals." We will list the hazards involved in each of the following areas within the hospital:

a. Laboratory (all labs)—Acids, xylene, and formaldehyde; infectious material.

b. Dental and dental labs—Acids; ammonia; developer; mercury; metal powder; ionizing radiation.

c. Medical maintenance—Degreasing solvents; mercury; acids; X-ray (ionizing radiation); epoxy and resins; noise, and welding.

d. Medical X-ray—Developers and ionizing radiation.

e. Surgery—Anesthetic gases, ionizing radiation, infectious material, and disinfectants.

f. Hospital civil engineering—Solvents, gases, noise, heat, and paints.

g. Other areas:

(1) Housekeeping—Disinfectants and detergents.

(2) Central Supply—Ethylene oxide (gas autoclave).

(3) In-patient and out-patient areas, physical therapy—Disinfectants.

Exercises (201):

1. What are some effects of exposure to halogenated hydrocarbons?

2. State the effects of aliphatic hydrocarbons and give some examples of this group of agents.

3. What is the route of entry into the body of phenols and phenolic compounds?

4. State hazards associated with fuel handling and tank cleaning.

5. What are some hazards associated with corrosion control operations?

6. List the major hazards involved in the various sections within the medical facility.

1-3. Control of Industrial Hazards

There are certain principles that relate to the methods that can be used to control hazards. The first principle is that all hazards can be controlled in some manner. This is not to say that all hazards are equally easy to control. Some hazard exposures by their very nature present difficult problems. However, exposure to the hazard can be limited through perserverance. Application of the golden rule, "Do unto others as you would have them do unto you," is useful when faced with the temptation to overlook a hazard exposure because of the difficulty required to solve it. As an environmental health specialist, you might put yourself in the worker's shoes; would you be willing to work in the same environment? When you answer this question, you will agree that all hazards can be controlled.

202. State how industrial hazards may be controlled.

Substitution. The first general method of control is the use of substitution. Substitution can take three forms:

- Substitution of materials.
- Substitution of process.
- Substitution of equipment.

Any one or combination of these forms of substitution may provide a method of control for a given hazard. Also, you can substitute using all three forms if necessary to obtain optimum results.

When considering substitution as a method of control, the first question that must be asked is: "Is there a material that is less toxic or flammable that can do the job?" Given the abundance of materials that are currently available in the industrial world, substitute materials may be available. These materials may do the job equally as well or they may provide results that are better or worse than those that are currently being obtained with the hazardous material being used. It may be necessary to give up some production efficiency in order to obtain the required control of the hazard exposure to the worker.

Common examples of material substitution include the use of trichloroethylene for carbon tetrachloride and aliphatic chlorinated hydrocarbons for benzene. In each of these cases, the material substituted exhibits less toxic properties than the original method being used. In the case of solvents, a further substitution of alkali and water detergent solutions may yield equal results with an even greater margin of safety for the worker. Thus, given a particular situation, the material being used might be substituted for by another material, with the results being the removal of the hazard exposure.

The second question that might be asked is: "Can the process be changed, thus removing the hazard exposure?" Or worded differently, "Is there a better way to do the job?" It may be possible to change the overall process being used or the procedures that are used within the process and thus eliminate the worker's exposure to hazardous materials or operations.

For example, when applying paint to a part using a spray gun, the possibility of changing to an alternative process such as dipping the part in a paint bath or flow coating the part should be considered. Each of the above substitute processes presents less potential contamination by toxic materials in the air. Another example would be the substitution of automated material-handling devices for manual or mechanical methods. This substitution has the additional benefit of eliminating costly manual labor. The substitution of closed system continuous processing for batch processing is an example of the general principle that was stated above. Where containers of toxic material are required to be opened and dumped into a system, one might consider changing the process to pump or convey the toxic materials from the storage area to the process rather than requiring that these materials be transported and dumped.

The final type of substitution is substitution of equipment. Is there a better type of equipment to do the job? Can engineering changes be made on the existing equipment to make the equipment less hazardous?

Examples of such substitution include the use of machine guarding on existing mechanical equipment and the substitution of automated equipment for manual methods. The addition of the catalytic converter to the automobile to reduce the emmission of pollutants is an example of making changes to existing equipment to reduce the hazard potential. The next logical step is to develop an automobile that operates on a fuel that is totally nonpolluting, e.g., the electric or steam automobile. This type of approach has led to the use of electric-powered lift trucks in place of gasoline-powered trucks.

Isolation. Another method available for control of hazard exposures is to remove the source of the hazard exposure from the worker's environment. This isolation can be accomplished in a number of ways. First, the source of the hazard exposure can be separated from the work area by removing the source and placing it in another location where the workers are unlikely to come in contact with it. A second method is to enclose or shield the source with physical barriers. Thus, although the source remains in the work area, it is separated from the workers and the work environment. A third method that was briefly mentioned in relation to substitution of equipment and process is to automate the process so that it operates within a closed system. A fourth method of isolation that relates to potential exposure from toxic materials or flammable materials stored in the production area is the removal and storage of these materials in a separate location.

There are many examples of isolation that have been used in industry. Tank farms that are used for storing toxic or flammable materials in areas apart from the work environment are a type of isolation. The automated processes that are used in chemical processing and petroleum refining are also examples. Heat barriers and soundproof enclosures have also been used in industry. Another common type of isolation is the removal of the worker to a control room that is separate from the processing area.

Ventilation. Ventilation is a useful method for controlling the air quality and the thermal exposures that the worker encounters. Ventilation can be used to remove air pollutants from the breathing zone of the workers. It can also be used to condition the air for worker comfort. In addition, ventilation systems can be designed to supply air to assure the proper operation of any local exhaust system in use.

Administrative. General administrative controls are those controls available to the organization that do not directly remove the source of hazard exposure from the workplace. These controls are usually effective when used with one of the other control methods previously outlined. Examples of general administrative controls available include the training of workers, monitoring the work area or the worker, scheduling of workers into the area, and preventive maintenance scheduling to assure proper functioning of the existing controls.

Training workers has a valuable, though sometimes overemphasized, part in control of hazard exposures. Through training, workers can be taught to identify potential hazards and report these hazards before an incident occurs. Training can be used to provide workers with methods and procedures that are useful in avoiding hazards and to develop error avoidance behaviors in the workers.

Another type of administrative control is monitoring the work area or worker. Continuous monitoring equipment can be placed in the work area. This equipment can sound a warning should the potential hazard exceed limits that can become harmful to the workers. Personnel samplers or dosimeters can also be used to monitor the exposure of the worker required to move in and out of areas where potential hazards exist.

After-the-fact biological monitoring of workers can be valuable in determining if a worker has been exposed to a hazard. This biological monitoring can involve pre- and post-employment medical exams to provide data upon which a comparison can be made. Periodic medical examinations should be scheduled for all workers who must work in potentially hazardous areas of the plant. It should be recognized that the results of such monitoring occur after exposure and as such may be too late for the worker involved unless the biological monitoring has the sensitivity to identify signs prior to damage occurring to the worker's body. Therefore, other control techniques should also be implemented.

The rotation of worker schedules can provide a method by which the exposure of any individual worker is controlled. Workers can be rotated in and out of hazardous areas during a shift. Workers can be rescheduled to different areas of the plant after a period of time to control possible cumulative effects of the potential hazard. Workers required to perform extremely physical tasks or to work in hot or cold areas can be given rest periods during which time their systems can recover from the exposure.

The use of preventive maintenance schedules is a valuable administrative control to eliminate potential hazard exposures. Maintenance on a regularly scheduled basis for potential hazardous operations is a *must*. If the worker is to be protected, the system must operate as it was designed. Normal wear can often cause problems to develop that will expose the worker to a hazard that could have been avoided had the equipment been maintained properly. This is also true for any control or monitoring equipment that is present within the workplace. Filters become clogged, fans do not always work as they were designed to work, and monitoring equipment can malfunction.

Other administrative controls that are available include such things as reports and statistics gathered from previous work-related injuries or illnesses and a recognition program that emphasizes regular inspections to identify potential hazard exposures before they become a problem. The existence of adequate emergency aid and emergency procedures can also be used as a method of control, though not as a control of a hazard but as a method to minimize the extent of individual injury and the number of people exposed when an emergency occurs.

Personal Protective Equipment. It is a general rule that personal protective equipment should be used only as a last resort and as a temporary measure until such time that more permanent controls can be installed. Quite often there is no alternative but to use personal protective equipment.

Each type of protective equipment and clothing used should be tested to assure it will do the job for which it was designed. It is also important to be sure the protective equipment and clothing are adequate to provide protection from the hazard. The use of goggles will protect the eyes from damage but will not provide protection for the face. Perhaps a face shield is more appropriate for the potential hazard exposure.

Protective equipment should be designed to provide minimum interference with the job being done. If this is not considered, the worker is likely to discard the protective equipment very quickly and take the chance of becoming exposed to the hazard. For example, large gloves may interfere with the requirement to perform small psychomotor manipulation of parts. These gloves may be substituted with latex form-fitting gloves that allow for the required movements but provide the same protection to the hands.

Types. The general types (fig. 1-2) of personal protective equipment may be categorized as follows:

- Skin protection—including gloves, suits, and aprons.
- Eye protection—including safety glasses, goggles, face shields, and hoods.
- Ear protection—including plugs and ear muffs.
- Respiratory protection—including air purifying respirators, air supplied respirators, and self-contained breathing units.
- Other protection—including safety shoes, diving suits, and environmental control suits.

It should be noted that personal protective equipment is a last resort control method. Other controls should be attempted before using personal protective equipment. Can ventilation help to solve the problem? Can a less hazardous material be substituted for a more hazardous one used in the process? Can engineering changes be made in the process and process equipment to eliminate the hazard? Can the worker be removed from contact with the source either by isolating the source or by isolating the worker? In those cases where none of the preferred methods of control can be utilized, then personal protective equipment should be prescribed.

Why people don't wear safety equipment. Throughout the United States, countless injuries occur annually to workers due to their failure to utilize proper protective equipment. There are many possible reasons why this occurs; however, the following five reasons are most common:

(1) Failure to properly publicize availability.
(2) Improper protection provided.
(3) Discomfort during use.
(4) Improperly maintained equipment.
(5) Failure of employers/employees to ensure that all concerned are knowledgeable of positive factors in using the equipment.

First, many workers are unaware that protective equipment is available for use. Most employers have the equipment, but do so to satisfy rules or regulations and are unconcerned as to whether or not it is used.

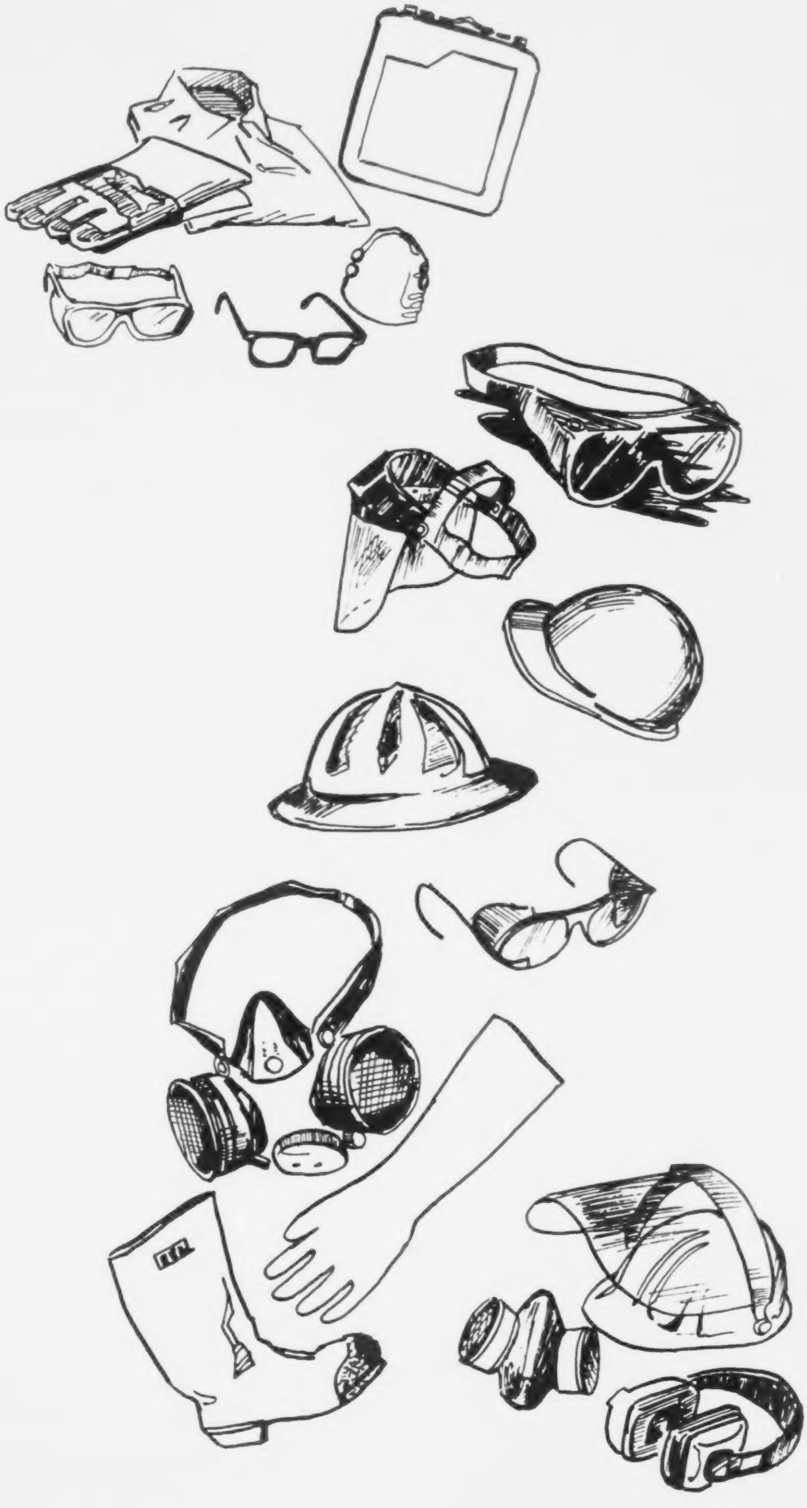


Figure 1-2. Types of protective equipment.

Frequently, you will find that employees do not wear their safety equipment because it doesn't work. If workers are given equipment that does not suit the need, almost assuredly it will be discarded.

Occasionally, protective equipment may be discarded because it's uncomfortable. When such an instance occurs, there is only one solution: fit each person with properly fitting equipment.

Frequently, equipment that has not had proper maintenance is named as the cause for failure to be used. When equipment is dirty, broken, or not sanitary, employees cannot be expected to use it when required to do so.

Finally, most employers/employees are unaware of the positive aspects associated with the utilization of protective equipment and do not realize or understand the positive healthy environment produced when doing so.

Although many things have been found to document reasoning for failure to use protective equipment, the facts suggest that countless injuries occur from repeated failure to use it. Supervisors, workers, upper management, and you must place more emphasis on safety equipment use (through worker education), not only out of concern for personal health, but also because a healthly worker is a productive worker. In the next section you will read about how occupational injuries/illnesses are reported. This "reporting" system (as well as your investigation of the incident) is another way we can try to control industrial hazards.

Exercises (202):

1. How can industrial hazards be controlled by substitution?

2. State four methods of isolation that may be used to control a hazard in the workplace.

3. What are some examples of administrative controls?

4. How is the training of industrial workers an important way to control industrial hazards?

5. What is the general rule that is followed when considering protective equipment as a means of controlling the hazard?

6. State five reasons why people are reluctant to wear safety equipment.

203. Describe how toxicological incidents are reported.

Occupational Illness and Injury Reporting. Mishaps that result in damage to Air Force facilities and equipment and/or injuries and occupational illnesses among employees seriously degrade operational readiness and wastefully expend tax dollars. Comprehensive investigations of such mishaps and accurate recordkeeping are essential to the success of the AFOSH program. Mishap investigations aimed at determining how and why the event occurred are necessary to prevent future occurrences of similar events. Accurate records are necessary to establish trends that lead to further investigation and to assess the effectiveness of the overall AFOSH program. Furthermore, certain records are necessary to comply with DOL/Federal agency recordkeeping and reporting requirements.

Purpose. The AF Form 190, Occupational Illness/Injury Report (fig. 1-3 and 1-4) has four basic purposes:

(1) Ensure appropriate evaluation and followup of occupational illness/injury to prevent their recurrence.

(2) Establishes a data repository.

(3) Standardizes data gathering.

(4) Establishes a system for obtaining information on these incidents from the field.

Injury/Illness definition. Many problems that occur with the Air Force toxicological incident reporting are caused by much confusion on what is considered an occupational injury or illness. You need to know the types of illnesses/injuries (as well as the difference between the two) to do an accurate job of reporting these incidents.

Occupational injury. An occupational injury is any injury such as a cut, fracture, sprain, amputation, etc., which results from a work accident or from an exposure involving a single incident in the work environment. (NOTE: conditions resulting from animal bites, such as insect or snake bites or from one-time exposure to chemicals, are considered to be injuries.)

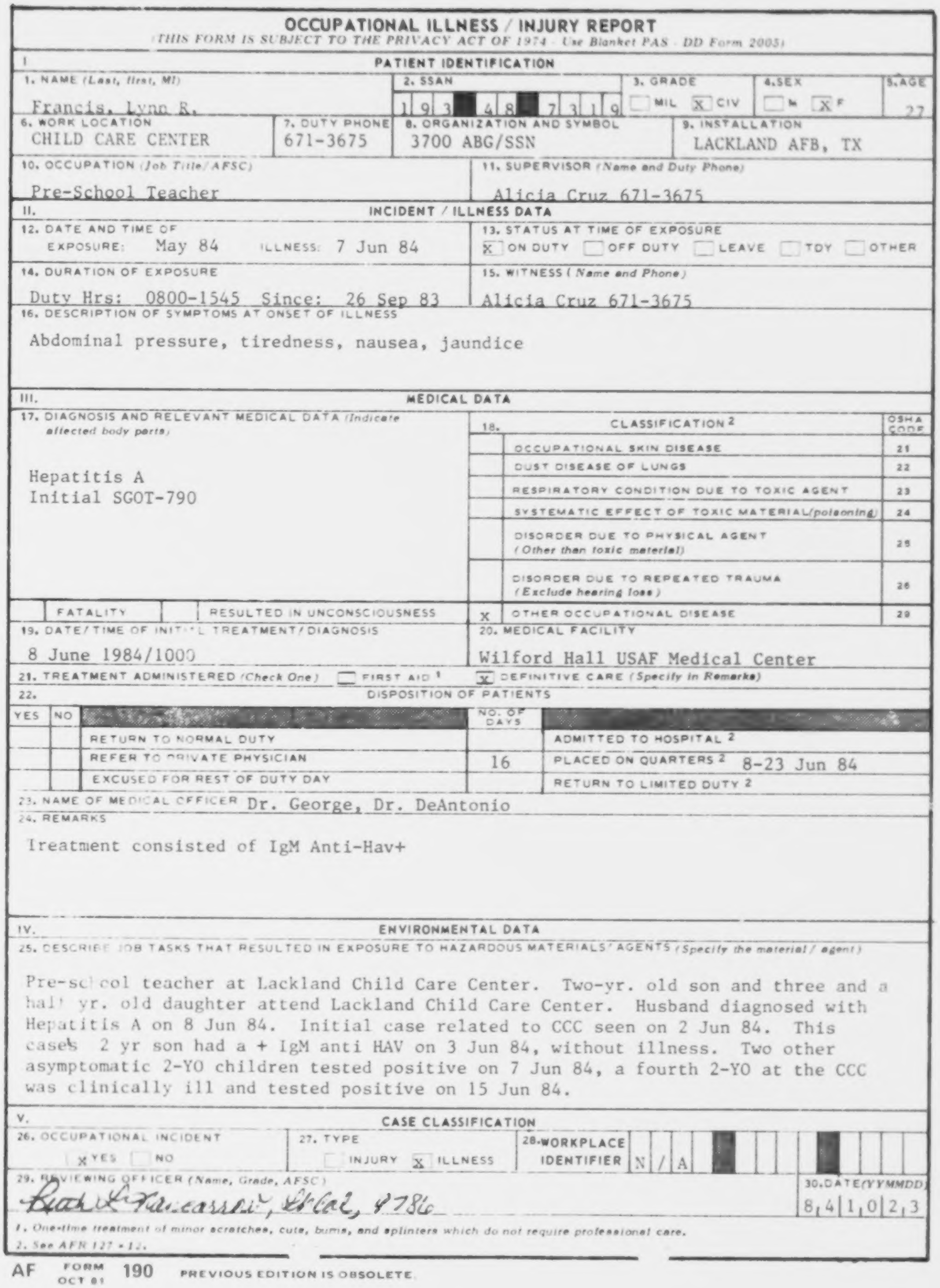
Occupational illness. An occupational illness of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion, or direct contact.

The following listing gives the categories of occupational illnesses and disorders that are utilized for the purpose of classifying recordable illnesses. For your information we have included examples of each category. These are typical examples, however, and should not be considered the complete listing of the types of illnesses and disorders that are to be counted under each category.

a. Occupational skin diseases or disorders—contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne, chrome ulcers; chemical burns or inflammations;

b. Dust diseases of the lungs (pneumoconioses)—silicosis, asbestosis and other asbestos-related diseases, coal workers pneumoconiosis, bysinosis, siderosis, and other pneumoconioses.

c. Respiratory conditions due to toxic agents—pneumonitis; pharyngitis; rhinitis or acute congestion due to chemicals, dusts, gases, or fumes; farmer's lung.



OCCUPATIONAL ILLNESS / INJURY REPORT

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

I. PATIENT IDENTIFICATION

1. NAME *(Last, first, MI)*: Francis, Lynn R.
2. SSAN: 1 9 3 ■ 4 8 ■ 7 3 1 9
3. GRADE: ☐ MIL ☒ CIV
4. SEX: ☐ M ☒ F
5. AGE: 27
6. WORK LOCATION: CHILD CARE CENTER
7. DUTY PHONE: 671-3675
8. ORGANIZATION AND SYMBOL: 3700 ABG/SSN
9. INSTALLATION: LACKLAND AFB, TX
10. OCCUPATION *(Job Title/AFSC)*: Pre-School Teacher
11. SUPERVISOR *(Name and Duty Phone)*: Alicia Cruz 671-3675

II. INCIDENT / ILLNESS DATA

12. DATE AND TIME OF EXPOSURE: May 84 ILLNESS: 7 Jun 84
13. STATUS AT TIME OF EXPOSURE: ☒ ON DUTY ☐ OFF DUTY ☐ LEAVE ☐ TDY ☐ OTHER
14. DURATION OF EXPOSURE: Duty Hrs: 0800-1545 Since: 26 Sep 83
15. WITNESS *(Name and Phone)*: Alicia Cruz 671-3675
16. DESCRIPTION OF SYMPTOMS AT ONSET OF ILLNESS: Abdominal pressure, tiredness, nausea, jaundice

III. MEDICAL DATA

17. DIAGNOSIS AND RELEVANT MEDICAL DATA *(Indicate affected body parts)*:
Hepatitis A
Initial SGOT-790

18. CLASSIFICATION[2]

	CLASSIFICATION[2]	OSHA CODE
	OCCUPATIONAL SKIN DISEASE	21
	DUST DISEASE OF LUNGS	22
	RESPIRATORY CONDITION DUE TO TOXIC AGENT	23
	SYSTEMATIC EFFECT OF TOXIC MATERIAL *(poisoning)*	24
	DISORDER DUE TO PHYSICAL AGENT *(Other than toxic material)*	25
	DISORDER DUE TO REPEATED TRAUMA *(Exclude hearing loss)*	26
x	OTHER OCCUPATIONAL DISEASE	29

☐ FATALITY ☐ RESULTED IN UNCONSCIOUSNESS

19. DATE/TIME OF INITIAL TREATMENT/DIAGNOSIS: 8 June 1984/1000
20. MEDICAL FACILITY: Wilford Hall USAF Medical Center
21. TREATMENT ADMINISTERED *(Check One)*: ☐ FIRST AID[1] ☒ DEFINITIVE CARE *(Specify in Remarks)*

22. DISPOSITION OF PATIENTS

YES	NO		NO. OF DAYS		
		RETURN TO NORMAL DUTY		ADMITTED TO HOSPITAL[2]	
		REFER TO PRIVATE PHYSICIAN	16	PLACED ON QUARTERS[2]	8-23 Jun 84
		EXCUSED FOR REST OF DUTY DAY		RETURN TO LIMITED DUTY[2]	

23. NAME OF MEDICAL OFFICER: Dr. George, Dr. DeAntonio
24. REMARKS: Treatment consisted of IgM Anti-Hav+

IV. ENVIRONMENTAL DATA

25. DESCRIBE JOB TASKS THAT RESULTED IN EXPOSURE TO HAZARDOUS MATERIALS/AGENTS *(Specify the material/agent)*

Pre-school teacher at Lackland Child Care Center. Two-yr. old son and three and a half yr. old daughter attend Lackland Child Care Center. Husband diagnosed with Hepatitis A on 8 Jun 84. Initial case related to CCC seen on 2 Jun 84. This case's 2 yr son had a + IgM anti HAV on 3 Jun 84, without illness. Two other asymptomatic 2-YO children tested positive on 7 Jun 84, a fourth 2-YO at the CCC was clinically ill and tested positive on 15 Jun 84.

V. CASE CLASSIFICATION

26. OCCUPATIONAL INCIDENT: ☒ YES ☐ NO
27. TYPE: ☐ INJURY ☒ ILLNESS
28. WORKPLACE IDENTIFIER: N / A
29. REVIEWING OFFICER *(Name, Grade, AFSC)*: [illegible], LtCol, 9786
30. DATE *(YYMMDD)*: 8,4 1,0 2,3

[1] One-time treatment of minor scratches, cuts, burns, and splinters which do not require professional care.

[2] See AFR 127-12.

AF FORM OCT 81 190 PREVIOUS EDITION IS OBSOLETE.

Figure 1-3. Sample, AF Form 190 (example of communicable disease reported as an occupational illness).

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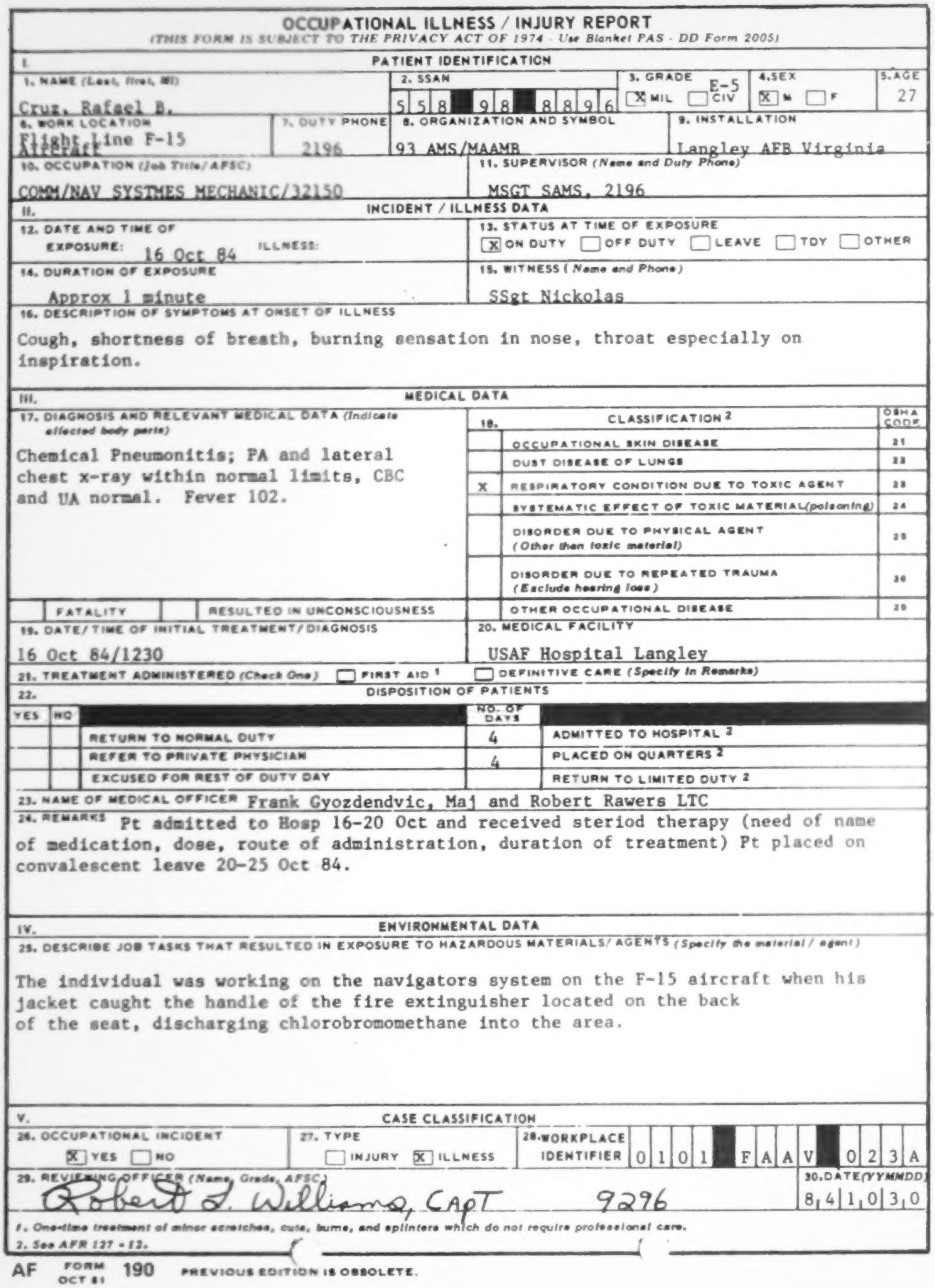


OCCUPATIONAL ILLNESS / INJURY REPORT

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

I. PATIENT IDENTIFICATION

1. NAME *(Last, first, MI)*: Cruz, Rafael B.
2. SSAN: 558 98 8896
3. GRADE: E-5 ☒ MIL ☐ CIV
4. SEX: ☒ M ☐ F
5. AGE: 27
6. WORK LOCATION: Flight Line F-15 Aircraft
7. DUTY PHONE: 2196
8. ORGANIZATION AND SYMBOL: 93 AMS/MAAMB
9. INSTALLATION: Langley AFB Virginia
10. OCCUPATION *(Job Title/AFSC)*: COMM/NAV SYSTMES MECHANIC/32150
11. SUPERVISOR *(Name and Duty Phone)*: MSGT SAMS, 2196

II. INCIDENT / ILLNESS DATA

12. DATE AND TIME OF EXPOSURE: 16 Oct 84 ILLNESS:
13. STATUS AT TIME OF EXPOSURE: ☒ ON DUTY ☐ OFF DUTY ☐ LEAVE ☐ TDY ☐ OTHER
14. DURATION OF EXPOSURE: Approx 1 minute
15. WITNESS *(Name and Phone)*: SSgt Nickolas
16. DESCRIPTION OF SYMPTOMS AT ONSET OF ILLNESS: Cough, shortness of breath, burning sensation in nose, throat especially on inspiration.

III. MEDICAL DATA

17. DIAGNOSIS AND RELEVANT MEDICAL DATA *(Indicate affected body parts)*: Chemical Pneumonitis; PA and lateral chest x-ray within normal limits, CBC and UA normal. Fever 102.

18.	CLASSIFICATION [2]	OSHA CODE
	OCCUPATIONAL SKIN DISEASE	21
	DUST DISEASE OF LUNGS	22
X	RESPIRATORY CONDITION DUE TO TOXIC AGENT	23
	SYSTEMATIC EFFECT OF TOXIC MATERIAL *(poisoning)*	24
	DISORDER DUE TO PHYSICAL AGENT *(Other than toxic material)*	25
	DISORDER DUE TO REPEATED TRAUMA *(Exclude hearing loss)*	26
	OTHER OCCUPATIONAL DISEASE	29

☐ FATALITY ☐ RESULTED IN UNCONSCIOUSNESS

19. DATE/TIME OF INITIAL TREATMENT/DIAGNOSIS: 16 Oct 84/1230
20. MEDICAL FACILITY: USAF Hospital Langley
21. TREATMENT ADMINISTERED *(Check One)* ☐ FIRST AID [1] ☐ DEFINITIVE CARE *(Specify in Remarks)*

22. DISPOSITION OF PATIENTS

YES	NO		NO. OF DAYS	
		RETURN TO NORMAL DUTY	4	ADMITTED TO HOSPITAL [2]
		REFER TO PRIVATE PHYSICIAN	4	PLACED ON QUARTERS [2]
		EXCUSED FOR REST OF DUTY DAY		RETURN TO LIMITED DUTY [2]

23. NAME OF MEDICAL OFFICER: Frank Gyozdendvic, Maj and Robert Rawers LTC
24. REMARKS: Pt admitted to Hosp 16-20 Oct and received steriod therapy (need of name of medication, dose, route of administration, duration of treatment) Pt placed on convalescent leave 20-25 Oct 84.

IV. ENVIRONMENTAL DATA

25. DESCRIBE JOB TASKS THAT RESULTED IN EXPOSURE TO HAZARDOUS MATERIALS/AGENTS *(Specify the material / agent)*: The individual was working on the navigators system on the F-15 aircraft when his jacket caught the handle of the fire extinguisher located on the back of the seat, discharging chlorobromomethane into the area.

V. CASE CLASSIFICATION

26. OCCUPATIONAL INCIDENT: ☒ YES ☐ NO
27. TYPE: ☐ INJURY ☒ ILLNESS
28. WORKPLACE IDENTIFIER: 0101 FAAV 023A
29. REVIEWING OFFICER *(Name, Grade, AFSC)*: Robert L. Williams, CApT 9296
30. DATE *(YYMMDD)*: 841030

[1] One-time treatment of minor scratches, cuts, burns, and splinters which do not require professional care.

[2] See AFR 127 - 12.

AF FORM OCT 81 190 PREVIOUS EDITION IS OBSOLETE.

Figure 1-4. Sample, AF Form 190 (clorobromethane accident).

31. BIOENVIRONMENTAL ENGINEERING SURVEY *(Summarize investigation of patient's exposure, indicate results of appropriate measurements and assessment of protective measures. Consultant reports in support of or in lieu of this survey should be referenced and attached)*

No Bioenvironmental Engineering Survey required.

The individual was working on the electornics systems on the F-15 aircraft. As he was trying to get between the navigators systems and the seat, his coat caught the handle of the fire extinguisher, which caused the chlorobromomethane to be released. The fire extinguisher was not mounted in the bracket correctly and the safety pin was removed. Since the accident, all fire extinguishers were inspected by the crew chiefs to insure that they were mounted correctly. Protective equipment was not required for this task.

32. DATE 8 4 1 0 2 7	33. SURVEY PERFORMED BY JAMES C. SILER, TSGT, 90770, SGPB

Figure 1-4. Sample, AF Form 190 (chlorobromethane accident) (con't).

d. Poisoning (systemic effect of toxic materials)—poisoning by lead, mercury, cadmium, arsenic, or other metals; poisoning by carbon monoxide, hydrogen sulfide, or other gases; poisoning by benzol, carbon tetrachloride, or other organic solvents; poisoning by insecticide sprays, such as parathion and lead arsenate; poisoning by other chemicals, such as formaldehyde, plastics, and resins.

e. Disorders due to physical agents (other than toxic materials)—heatstroke, sunstroke, heat exhaustion, and other effects of environmental heat; freezing, frostbite, and effects of exposure to low temperature; effects of ionizing radiation (e.g., isotopes, X-rays, radium); and effects of nonionizing radiation (e.g.,welding flash, ultraviolet rays, microwaves, sunburn).

f. Disorders associated with repeated trauma—noise-induced hearing loss; synovitis, tenosynovitis and bursitis, Raynauds phenomena, and other conditions due to repeated motion, vibration, or pressure.

Procedures for reporting. The SF 513 (Consultation Sheet) is sent with the patient and medical record to EHS. You may also find suspected occupationally related conditions on the emergency room log of patients or on civilian personnel forms that are submitted directly to CCPO by the affected worker.

At this point you should start to fill out the AF Form 190. In order to do this, you need to interview the patient and/or witnesses for a description of the incident or exposure. Sometimes you may need to get information from the BEE if the case involves toxic chemicals or physical agents without survey data in the case file or if unusual circumstances existed. When the BEE survey or comments are complete, the bioenvironmental engineering specialist files a copy in the case file and becomes responsible for making sure that corrective action is started if required (i.e., an assignment of a risk assessment code (RAC) to the hazard; engineering controls; and/or protective equipment).

After this, you complete AF Form 190 and summarize your findings on the SF 513 by commenting on the specific job factors, actions required, and recommended medical followup. For the incident, the disposition of the AF Form 190 is as follows:

a. The original of AF Form 190 and SF 513 is placed in the patient's medical record (2100 series).

b. copies of both forms are sent to the health Care provider (HCP) and placed in your files. The HCP needs to receive feedback on any followup actions that were taken. You must maintain an OSHA required file for these, and you need this data for your base-level trend analysis.

c. A copy of the AF Form 190 also is sent to Ground Safety if it is an injury, and if it is an illness, to hospital resource management office to be attached to monthly report of patients. The resource management office then sends this report to your major command (MAC, TAC, AFSC, etc.). It is then reviewed by the major command environmental health officer and then forwarded to the Air Force Medical Service Center (AFMSC) for computerization. This section then tallies the data and reports the results annually.

Exercises (203):

1. What are the four purposes of the AF Form 190?

2. How is an injury different than an illness?

3. If a worker from the fuel systems repair shop splashed fuel in his or her eyes, is this an injury or an illness?

4. Is contact dermatitis from solvent exposure considered an injury or an illness?

5. What information may you need to get so you can fill out the AF Form 190.

6. Where do the originals of AF Form 190 and SF 513 go?

7. Where are copies of these forms sent?

1-4. Pregnancy and the Workplace

Until recently, the civilian industrial work force and the Air Force counterparts have been made up almost completely of men, and the rules, laws, and regulations that exist or have existed have been devised primarily with men in mind. Women comprise approximately 20 percent of the overall Air Force population, many of whom are working side by side with men in hazardous jobs.

During your initial training as an environmental medicine specialist, you learned a lot about various hazards and the surveillance and control measures used to deal with them. Keep in mind that the permissive exposure limits (PEL's) you learned about were developed for healthy males working an 8-hour day, 40-hour work week. How do these values relate to our pregnant personnel? You will be responsible to ensure that women who become pregnant at your base are not tasked to work at jobs that may increase the risk of miscarriage, stillbirth, or a deformed infant. To better understand this complex program, we will discuss fetal development, the types of hazards, and the responsibilities of performing pregnant worker evaluations. Let's begin with a review of what happens during early pregnancy and why this period is so critical. Then we'll discuss the work environments and toxic materials that may be hazardous to the unborn child.

204. Identify work environments potentially hazardous to the unborn.

Fetal Development. Refer to figure 1-5 during this discussion on fetal development. Pregnancy begins when the ovum or egg in the female is successfully fertilized by the male sperm. This occurs in the lower third of the fallopian tube. At this point, the individual is not likely to suspect that she is pregnant. The fertilized egg migrates (in approximately 10 days) to implant itself in the uterine wall. Prior to this implantation, there is usually little danger of malformations due to outside influences (hazards) because outside influences have no means of access to the fertilized egg. If any damage were to occur at this time it would most likely result in destruction and loss of pregnancy. Approximately 20 percent of all pregnancies end in spontaneous abortion without known cause.

The period after implantation through the end of the third month is the most critical stage for the fetus. During this period, body organs are being formed (such as heart, lungs, kidneys, brain, and skeletal system). It's during this time that there is a big chance for malformations.

At 4 weeks, the heart of the unborn child pumps blood; the spinal canal and digestive system is forming, and buds for arms and legs are present. By this time the mother has missed one period; however, the urine pregnancy test may be negative (e.g., depends on amount of hormone excreted).

At 8 weeks, facial features are forming; arms, legs, hands, and feet begin to show distinct division. At this point the mother has missed two periods. She is more aware she may be pregnant; the urine pregnancy test may be positive.

At 12 weeks, the fetus is 3 inches long; weighs 1 ounce; arms, hands, fingers legs, feet, and toes are fully formed; external ears are present; and the heartbeat can be heard. At this point the risk of abnormalitites and/or deformitites decreases.

Types of Hazards. Table 1-2 depicts various agents found in occupational exposures that have been associated with actual or potential reproductive or systemic effects. However, the list is not a complete inventory of proven or suspected agents.

The systemic toxicity shown is primarily from the findings reported in humans. The data on reproductive effects are from human and/or animal research. The exposure standards are those existing or proposed at the present time and may be changed as more information becomes available. Some environmental factors have been studied which we will talk about separately.

Nonionizing radiation. Guidance concerning pregnant females working with or around radio-frequency (RF) emitters in avionics shops, on flight lines, in communications facilities, etc., is given in AFOSH Standard 161-9. This standard states that "As long as the RF radiation levels do not exceed the respective PELs in any 6-minute period, personnel exposures can continue for an indefinite time." In other words, any RF environment which is considered safe for the adult female is also considered safe for the fetus. Special medical restrictions on exposure to radiation refer to *ionizing* radiation such as X-rays. Generally speaking, there are no RF emitters in the avionics/communications environment which are capable of producing ionizing radiation. Some very high powered ground radar transmitters do produce X-rays and are shielded with lead to prevent leakage. Cases involving these systems should be evaluated individually by the BEE. The organization commander may request advice on this topic from your office and should be given this information and be assured that no additional hazard exists because of the female's pregnant condition. The commander, of course, must be allowed to make the final decision after considering the individual's emotional condition and any other significant factors.

Ionizing radiation. Military and civilian women are assigned by the Air Force to jobs requiring possible occupational exposure to ionizing radiation. The potential exposure in some of these jobs is so low that it is virtually impossible for individuals performing them to receive annual whole body exposures above the limit to which any nonradiation workers (including children and pregnant women) may be exposed under present Federal radiation protection guidance; i.e., 500 millirem/year (mrem/yr). Other jobs, such as industrial radiography, medical fluoroscopy, and certain nuclear medicine procedures may result in an individual routinely receiving measurable radiation doses which can total more than 500 mrem/yr. Should workers in these latter jobs become pregnant, concern must be given to protecting the unborn child, who is known to be particularly sensitive to effects of ionizing radiation.

National exposure guidelines have been established by the National Council on Radiation Protection and Measurements (NCRP) to minimize the risk to the unborn child. These guidelines recommend that the total dose to the child during the pregnancy be kept as low as practicable but should never exceed 500 millirems. The U.S. Nuclear Regulatory Commission (NRC) has made these guidelines part of their regulatory requirements which must be followed by all persons and organizations using radioactive materials regulated by the NRC.

In the past, Air Force policy has required immediate removal of workers with confirmed pregnancies from specific duties requiring occupational exposure to ionizing radiation until the conclusion of the pregnancy. With improvements in the design of radiation-producing equipment and shielding of facilities, advances in the personal dosimetry system we use to monitor and record worker exposure, and formulation of medical policies and procedures for management of pregnancy in all workers, the continuation of such a restrictive policy is no longer practical nor required.

Biological agents. Although susceptibility to infection does not seem to be increased in pregnancy, infection during pregnancy is likely to have more serious consequences. In certain diseases, the infectious organism may cross the placental barrier causing abortion, fetal death, fetal infection, or fetal abnormalities.

Infection is also significant for the increased burden it places on the maternal physiology and the possible adverse effects of drugs that may be required for treatment. More time may be required for recovery. Consequently, the pregnant worker should be protected against undue risk of exposure to infections. For example, it might be unwise for a pregnant woman to be employed in a contagious disease unit or in a bacteriology laboratory.

The timing of a viral infection relative to fetal organ development and the specific response of the fetus to the

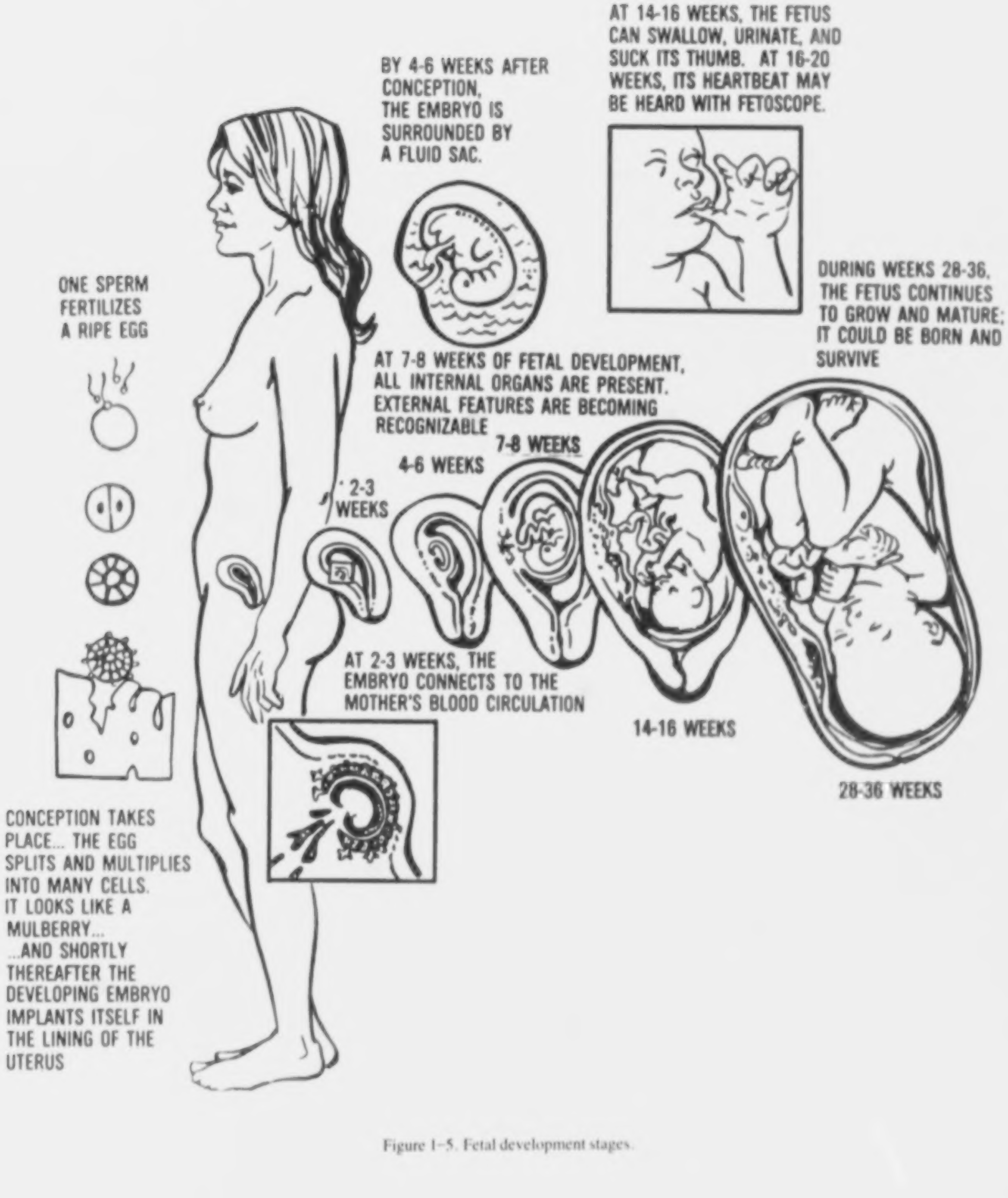

AT 14-16 WEEKS, THE FETUS CAN SWALLOW, URINATE, AND SUCK ITS THUMB. AT 16-20 WEEKS, ITS HEARTBEAT MAY BE HEARD WITH FETOSCOPE.
BY 4-6 WEEKS AFTER CONCEPTION, THE EMBRYO IS SURROUNDED BY A FLUID SAC.
ONE SPERM FERTILIZES A RIPE EGG
DURING WEEKS 28-36, THE FETUS CONTINUES TO GROW AND MATURE; IT COULD BE BORN AND SURVIVE
AT 7-8 WEEKS OF FETAL DEVELOPMENT, ALL INTERNAL ORGANS ARE PRESENT. EXTERNAL FEATURES ARE BECOMING RECOGNIZABLE
7-8 WEEKS
4-6 WEEKS
2-3 WEEKS
AT 2-3 WEEKS, THE EMBRYO CONNECTS TO THE MOTHER'S BLOOD CIRCULATION
14-16 WEEKS
28-36 WEEKS
CONCEPTION TAKES PLACE... THE EGG SPLITS AND MULTIPLIES INTO MANY CELLS. IT LOOKS LIKE A MULBERRY... ...AND SHORTLY THEREAFTER THE DEVELOPING EMBRYO IMPLANTS ITSELF IN THE LINING OF THE UTERUS

Figure 1-5. Fetal development stages.

TABLE 1–2
OCCUPATIONAL REPRODUCTIVE HAZARDS

	SUSPECTED REPRODUCTIVE EFFECTS				
AGENTS	Carcinogenesis	Reduced Fertility	Spontaneous Abortion	Mutagenesis	Teratogenesis
Heavy Metals					
Cadmium	•	•			•
Lead		•	•		•
Mercury			•		•
Organic Solvents					
Benzene (benzol)	•				•
Halogenated hydrocarbons					
Ethylene dibromide	•	•			
Polychlorinated biphenyls (PCB's)	•	•	•		
Tetrachloroethylene (Perchloroethylene)	•			•	•
Hypoxic agents					
Carbon monoxide					•
Anesthetic gases	•	•	•	•	•
Pesticides					
Carbaryl		•			
Chlorinated hydrocarbons (e.g. chlordane)	•			•	
Chlordecone (kepone)	•	•			
Ionizing radiation (Whole body)					
X-rays and gamma rays	•	•	•	•	•
Miscellaneous substances					
Ethylene Oxide				•	

•Animal and/or human data

•Evidence only male infertility; no data on females viral infection are critical for fetal outcome. Maternal viremia may lead to abortion or stillbirth. It may also be responsible for severe developmental defects or evidence of neonatal infection. The more common virus diseases are rubella, measles, mumps, herpes zoster, herpes simplex, influenza A-strain, hepatitis B, and chickenpox. Immunization, especially with live or attenuated vaccines, should be completed before pregnancy. Jobs that require continuing exposure to these viruses pose a special problem for the pregnant worker. Under ordinary circumstances, isolation of the pregnant worker from known cases is advisable.

The protozoan agents that cross the placental barrier causing congenital disease or persistent postnatal infection are toxoplasma gondii, plasmodia (malaria), and trypanosomes.

Waste anesthetic gases and vapors. Recent data suggest that there is a greater than ordinary incidence of congenital abnormalities in children born of women exposed to anesthetic gases. There may also be an increase in spontaneous abortion. A number of the halogenated hydrocarbons, including vinyl chloride and the freons, have structural and physiologic activity similar to the anesthetic gases and are being studied for such effects.

It has been suggested that even small quantities of the waste gases to which operating room personnel may be exposed may decrease perception, acuity, and intellectual capacity. It is not known whether exposure to these substances causes additive effects; however, it is known that the gases themselves are persistent, may build up, and do pass the placental barrier. Properly designed and used low-leak anesthesia equipment attached to gas scavenging systems should provide adequate protection.

Heavy metals. The heavy metals are capable of general systemic toxicity, including damage to nervous system, kidneys, and blood-forming organs.

Lead. The increased numbers of abortions and stillbirths among female workers exposed to excessive lead levels have long been recognized, and children of such workers were found to be highly susceptible to neonatal convulsions. High concentrations of lead have been demonstrated in the placenta, liver, and brain of stillborn infants born to lead workers. Newborns of nonoccupationally exposed women have been found with measurable quantities of lead in their blood correlating well with the mother's blood lead level. Historic evidence of pregnancies fathered by males employed in the lead industry shows a greater incidence of spontaneous abortions and stillbirths. Recent data suggests an effect of lead on the male germ cells.

Lead may enhance the toxic properties of certain medications; for example, it has been shown to potentiate the effects of lithium on the liver. Lead compounds have been shown to be teratogenic and carcinogenic in animals.

Mercury. Inorganic and organic mercury have been known for some time to pass the placental barrier. Recent reports from Japan (Minimata disease) indicate that infants of women who ingested food contaminated with methyl mercury have damaged central nervous systems, kidneys, and other organs. Severe cerebral palsy and mental retardation have resulted in many cases. Infants were found to be affected even when the mothers did not show evidence of clinical toxicity. In some breast-fed infants, exposure from ingestion of mercury contaminated mother's milk added to the intrauterine exposure. Inorganic mercury has been reported to cause abortions, and mercury has been found in the stillborn babies of treated mothers.

Other metals. A number of metals are known to injure the immune response of the fully developed organism. For example, the response of phagocytes is impaired by cadmium as well as lead. These metals also decrease the development of antibody in a variety of animals, including the mouse and rat. Pregnancy intensifies the pulmonary symptoms in women with beryllirosis and in the past was associated with high maternal mortality.

Persistent organic compounds. Recent experience with polychlorinated biphenyls (PCBs), polybrominated biphenyls (PBBs), kepone, dioxin, and mirex indicates that they can adversely affect reproduction. Infants born to mothers with PCB poisoning from ingestion of contaminated cooking oil had decreased birth weights, and some showed brownish discoloration of the skin, indicating transplacental passage of the PCBs. These compounds are also transmitted to the newborn through nursing. If the women has ingested these compounds in food, an abbreviated period of nursing may be suggested. If the exposure has been excessive, breast feeding may not be advisable.

Halogenated hydrocarbons. Hepato-renal toxicity is most often associated with the many halogenated hydrocarbons. Familiar ones are tricholorethylene, perchlorethylene, vinyl chloride, tetra-chloro-dibenzo dioxin (TCDD), heptachlor epoxide, and oxychlordane. Very little is known about the effects of these chemicals in pregnancy. Pregnant women may be more susceptible to the effects, reflecting their increased metabolic rate.

Some research shows an association of these compounds with mutagenesis and carcinogenesis. In some studies, chromosomal aberrations have been found; and increased fetal mortality was noted among wives of vinyl chloride workers.

Carbon disulfide. Although carbon disulfide is primarily a neurotoxin, several foreign studies have reported reproductive effects, including increased spontaneous abortion, threatened abortion, and infertility. Spermatic disorders in men have also been reported.

Medications. Almost all medications and chemicals may cross the placenta and concentrate in the fetus; however, the effects of an agent may vary from negligible to catastrophic, depending upon (1) the agent and dosage administered, (2) the time of administration, (3) the duration of exposure, and (4) the genetic makeup of the mother and fetus. The period of fetal development during which drug risk is critical is during the time organs are developing (i.e., from the 13th to 56th day of gestation). Most exposure to medications is in therapeutic use. Therefore, prescription medications during pregnancy should be coordinated with the obstetrician and self-medication avoided.

Exercises (204):

1. What is the effect of nonionizing radiation on the unborn?

2. What is the exposure standard of ionizing radiation for pregnant females?

3. How is exposure of the mother to biological agents a hazard to the unborn child?

4. What can be done to protect against exposure to waste anesthetic gases for pregnant workers in the operational room?

5. What effects does heavy metal (e.g., lead, mercury) exposure have on the unborn?

6. In addition to the toxic agent crossing the placenta barrier to the unborn child, in what other way may the mother serve as a mode of transmission for these toxins to her child?

205. Describe environmental health's responsibilities for pregnant worker evaluations.

Disposition of Pregnant Workers. AFR 160–12, para 8, describes the care of pregnant active duty personnel. The program set up at your base to do this may be slightly different from the guidelines we will describe.

The proper management of pregnant active duty personnel requires cooperation among the patient, attending health care practitioners, physical examination and standards (PES), environmental health, the workplace supervisors, and the profile officer.

Supervisors must inform workers of potential hazards in their workplaces. It is particularly important that female members understand the necessity of confirming pregnancy at the earliest possible time. This briefing can be done as part of the incoming orientation, their OJT program, etc.

Local hospitals or clinics must allow early pregnancy testing (before 2nd missed period) for those females whose jobs involve potential exposure to teratogenic chemicals or physical agents. There is a serum pregnancy test that is sensitive enough to give accurate test results within 12 hours of conception.

Pregnant Worker Evaluations. Pregnant females should not be excluded from all duties solely because of the potential for exposure to occupational hazards or toxic substances. Some duty restrictions may be appropriate, but complete excusal of the pregnant member from all military duties before delivery is seldom indicated. Determine duty restrictions, if required, based on objective medical reasons related to the work environment. Areas with predetermined duty restrictions have a definite policy which makes your job of evaluation of patients working in these areas much easier. It's the areas that haven't been evaluated that can cause problems. In these cases you should research the toxic materials (and work procedures) and present the information to your aerospace medicine council for a determination.

As we stated earlier, all concerned must cooperate if this is to be an effective program. The patient, health care provider, and you share an important function.

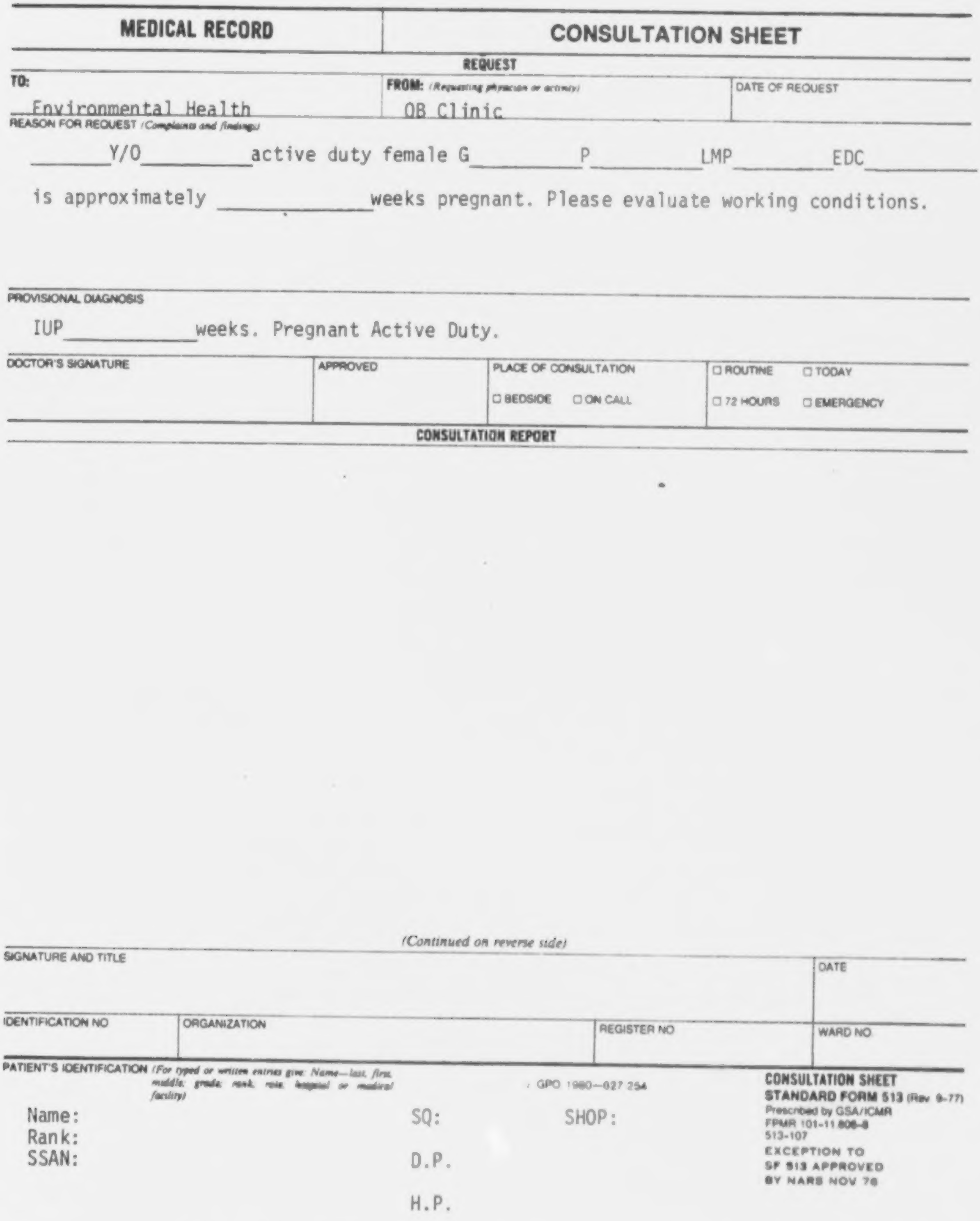
Patient action. The patient must go to a clinic as soon as possible when she suspects she is pregnant. Good prenatal care is the best preventive medicine.

Health care provider (HCP) action. This individual (nurse practitioner, physician, or midwife) confirms pregnancy with a test and exam. He or she initiates the SF 513, Consultation Sheet (fig. 1-6), and sends it to EHS with the patient and her medical record.

After your input, the HCP drafts AF Form 422, Physical Profile Serial Report (fig. 1-7). This form must include P4 (restrictions on physical tasks "P" factor), X4 (restrictions on lifting tasks "X" factor), expiration date (this date is normally 4 weeks after delivery), and the remarks with your recommended restrictions (as well as any others that may be necessary). It is then forwarded to the physical examination section (PES) for profiling and the typing of the final copy.

Environmental health service action. You should interview the pregnant member. Educating the patient is very important during this interview. In order to do this, you must determine actual duties, (e.g., the chemicals she uses and work procedures). Obtain a medical history (i.e., any previous abortions) and a social history (i.e., smokes, alcohol use, hobbies, etc.). These findings should be documented on the SF 513. Discuss hazards/chemical/restrictions you'll recommend. Don't let the worker abuse the system to avoid work she's qualified to do. You should request a statement from her supervisor (fig. 1-8) describing the work environment including chemicals used, specific duties, and physical requirements. If you need additional information, forward a copy of the SF 513 to the BEE with a suspense. You should read the case files of the shops and chemicals used so that you can determine which areas are greatest risk to pregnant workers. We know of some areas which may be hazardous to the unborn. These areas have predetermined duty restrictions (i.e., definite policy on how to protect the pregnant worker).

Duties with ionizing radiation. Each female who may be occupationally exposed to ionizing radiation must be informed by her supervisor of the Air Force policy regarding ionizing radiation exposures (the specific policy will be discussed a little later), the recommendations of the NCRP to limit radiation exposure during pregnancy, and the importance of immediately notifying her supervisor if she suspects she is pregnant. Supervisors should give the individual the opportunity to ask questions and should



MEDICAL RECORD	**CONSULTATION SHEET**

REQUEST

TO:	FROM: *(Requesting physician or activity)*	DATE OF REQUEST
Environmental Health	OB Clinic	

REASON FOR REQUEST *(Complaints and findings)*

______Y/O________active duty female G________P________LMP_______EDC________

is approximately ___________weeks pregnant. Please evaluate working conditions.

PROVISIONAL DIAGNOSIS

IUP__________weeks. Pregnant Active Duty.

DOCTOR'S SIGNATURE	APPROVED	PLACE OF CONSULTATION	
		☐ BEDSIDE ☐ ON CALL	☐ ROUTINE ☐ TODAY ☐ 72 HOURS ☐ EMERGENCY

CONSULTATION REPORT

(Continued on reverse side)

SIGNATURE AND TITLE			DATE
IDENTIFICATION NO	ORGANIZATION	REGISTER NO	WARD NO

PATIENT'S IDENTIFICATION *(For typed or written entries give: Name—last, first, middle; grade; rank; rate; hospital or medical facility)*

GPO 1980—027 254

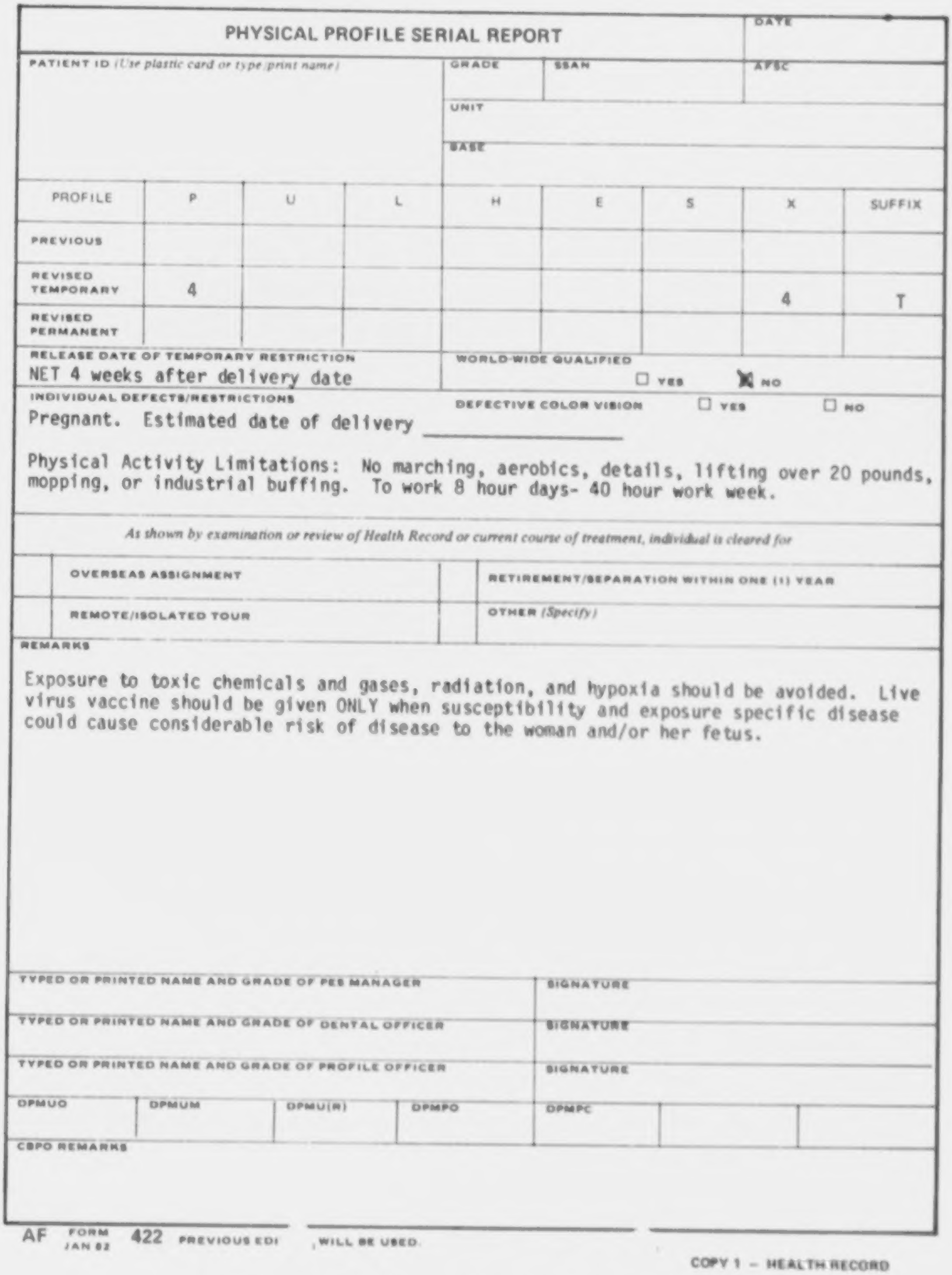
Name:
Rank:
SSAN:

SQ:
D.P.
H.P.

SHOP:

CONSULTATION SHEET
STANDARD FORM 513 (Rev. 9-77)
Prescribed by GSA/ICMR
FPMR 101-11.806-8
513-107
EXCEPTION TO
SF 513 APPROVED
BY NARS NOV 78

Figure 1–6. Sample, SF 513 (consultation sheet for an occupational pregnant worker evaluation).



PHYSICAL PROFILE SERIAL REPORT

DATE

PATIENT ID *(Use plastic card or type/print name)*	GRADE	SSAN	AFSC
	UNIT		
	BASE		

PROFILE	P	U	L	H	E	S	X	SUFFIX
PREVIOUS								
REVISED TEMPORARY	4						4	T
REVISED PERMANENT								

RELEASE DATE OF TEMPORARY RESTRICTION
NET 4 weeks after delivery date

WORLD-WIDE QUALIFIED ☐ YES ☒ NO

INDIVIDUAL DEFECTS/RESTRICTIONS

DEFECTIVE COLOR VISION ☐ YES ☐ NO

Pregnant. Estimated date of delivery ____________

Physical Activity Limitations: No marching, aerobics, details, lifting over 20 pounds, mopping, or industrial buffing. To work 8 hour days- 40 hour work week.

As shown by examination or review of Health Record or current course of treatment, individual is cleared for

☐	OVERSEAS ASSIGNMENT	☐	RETIREMENT/SEPARATION WITHIN ONE (1) YEAR
☐	REMOTE/ISOLATED TOUR	☐	OTHER *(Specify)*

REMARKS

Exposure to toxic chemicals and gases, radiation, and hypoxia should be avoided. Live virus vaccine should be given ONLY when susceptibility and exposure specific disease could cause considerable risk of disease to the woman and/or her fetus.

TYPED OR PRINTED NAME AND GRADE OF PES MANAGER	SIGNATURE
TYPED OR PRINTED NAME AND GRADE OF DENTAL OFFICER	SIGNATURE
TYPED OR PRINTED NAME AND GRADE OF PROFILE OFFICER	SIGNATURE

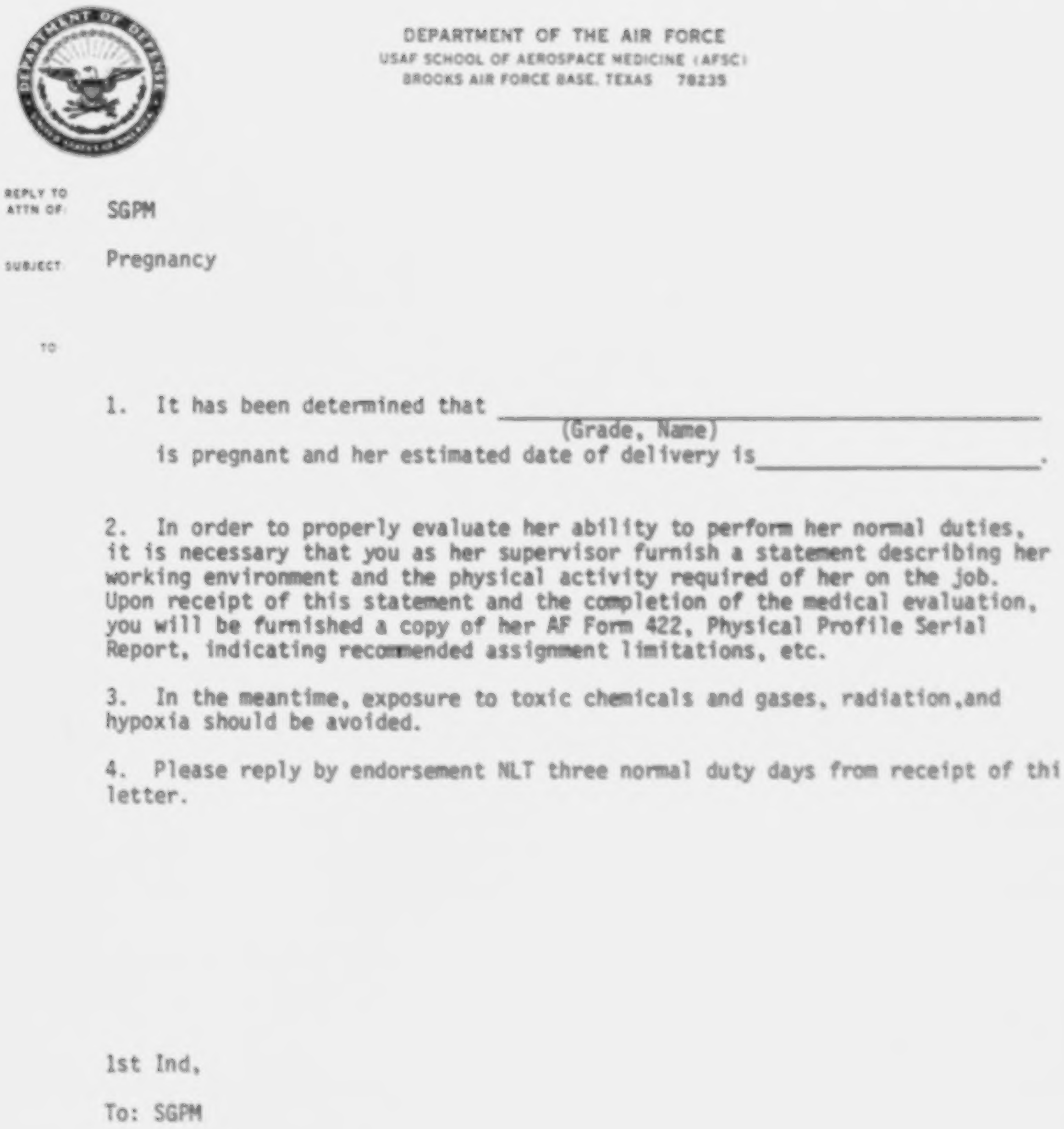
DPMUO	DPMUM	DPMU(R)	DPMPO	DPMPC		

CBPO REMARKS

AF FORM JAN 82 422 PREVIOUS EDI ,WILL BE USED.

COPY 1 – HEALTH RECORD

Figure 1–7. Sample, AF Form 422 (physical profile serial report for pregnant workers).



DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFSC)
BROOKS AIR FORCE BASE, TEXAS 78235

REPLY TO ATTN OF: SGPM

SUBJECT: Pregnancy

TO:

1. It has been determined that ______________________________
(Grade, Name)
is pregnant and her estimated date of delivery is________________.

2. In order to properly evaluate her ability to perform her normal duties, it is necessary that you as her supervisor furnish a statement describing her working environment and the physical activity required of her on the job. Upon receipt of this statement and the completion of the medical evaluation, you will be furnished a copy of her AF Form 422, Physical Profile Serial Report, indicating recommended assignment limitations, etc.

3. In the meantime, exposure to toxic chemicals and gases, radiation,and hypoxia should be avoided.

4. Please reply by endorsement NLT three normal duty days from receipt of thi letter.

1st Ind,

To: SGPM

Figure 1-8. Sample letter to supervisor requesting description of pregnant workers' working conditions.

maintain documentation in which she acknowledges in writing that she has been advised of this policy. The BEE and you should assist the supervisor in answering technical or medical questions.

The Air Force policy regarding duties with exposures to ionizing radiation states that a woman who is occupationally exposed to radiation and who may receive a whole body exposure greater than 500 mrem/yr either in the course of routine duties or as a result of a credible accident involving the radiation sources with which she works must have any suspected pregnancy evaluated by a physician or appropriate practitioner as soon as practical, but no later than 15 days from the date of notification of her supervisor. Female civilian personnel may be evaluated for pregnancy by their own physician or by an Air Force physician. If the pregnancy is confirmed, the base bioenvironmental engineer (BEE) then evaluates the individual's specific duties involving exposure to radiation. This evaluation should include consideration of the workplace and the source of radiation, the individual's past history of exposure to radiation as documented by personal dosimetry records, current radiation measurements applicable to her specific tasks, current exposure histories of coworkers, and likely exposures which would be incurred in the event of a credible accident.

If the BEE determines that it is unlikely that the woman would receive a total exposure during the term of the pregnancy (including the period preceding confirmation of the pregnancy) in excess of 500 mrem, she can continue in her radiation duties. If the individual is not already on the Air Force Personal Dosimetry Program, she must be placed on the program for the duration of her pregnancy. The BEE should arrange with the USAF Occupational and Environmental Health Laboratory (USAF OEHL/RZD, Brooks AFB TX 78235) to receive, in addition to the laboratory's routine written report, telephone notification of the individual's dosimetry results as soon as each dosimeter is processed by the laboratory. Should exposure results indicate a trend which, if continued, could result in exceeding the 500 mrem limit, a re-evaluation should be made by the BEE of whether the pregnant worker should continue her radiation duties, be restricted from certain duties as described in the next paragraph, or be removed entirely from occupational exposure.

If the BEE determines it is likely that the worker would receive a total whole-body dose during pregnancy exceeding 500 mrem, then she must be restricted from those specific duties contributing to significant exposures. This may result in total removal from radiation duties (such as performing industrial radiography) or only partial removal (constraining medical X-ray technicians to limited diagnostic procedures not involving fluoroscopy, etc.). In any case where the woman is allowed to continue limited radiation duties, she must be monitored with a personal dosimeter as described earlier.

Special consideration must be made when a pregnant worker's radiation duties involve the operation of high output sources such as used in industrial radiography, medical therapy, etc., or the use of radioactive materials other than in sealed sources. Pregnant workers must not continue in duties involving these sources without specific approval of HQ AFMSC/SGPA.

In cases of active duty members, reassignment of duties should be according to AFR 160-12, paragraph 18. Civilian employees should be temporarily assigned duties not involving risk of radiation exposure as prescribed by applicable civilian personnel assignment procedures.

Flying duties. Flying duties as a pilot, navigator, physician, nurse, technician, crew chief, or physiological training instructor should be stopped and the pregnant female should be grounded for the duration of the pregnancy This action is necessary because of the increased risk of hypoxia if she is allowed to continue various flying duties.

Duties with exposure to waste anesthetic gases. These workers should be removed from risks of exposure for the first 4 months of pregnancy. They may be reassigned to normal duties if the scavenging system reduces exposure levels below half the permissive exposure limit. If the controls are not adequate, pregnant females should be removed from risk of exposure to waste anesthetic gases for the duration of pregnancy.

Exposures above the permissible exposure limit. In all areas with toxic chemicals, the permissible exposure limit (PEL) becomes the ceiling value, if it can't be controlled; the pregnant females should be removed from the work area.

Exercises (205):

1. Who initiates the SF 513?

2. Under this program what responsibility does the supervisor have?

3. Describe items that would be included in your interview of the patient.

4. Cite areas that have predetermined duty restrictions for the pregnant female.

5. What should you do if you don't have enough information to evaluate the effect of the pregnant worker's industrial workplace?

1-5. Health Education

The Air Force is presently directed by a Presidential mandate to reduce occupational illnesses and injuries by 3 percent a year. This factor is one of the items that is really driving the importance of occupational health education as a major way to reduce the occurrence of occupationally related diseases. The Air Force is so concerned with this that it is becoming a "special interest item" on medical inspection team visits.

206. Cite the purpose, extent, and requirements of health education training programs.

Training Programs. Studies indicate that an individual's past occupational experiences are a factor in reducing the incidence of repeated job-related accidents, and training, where properly applied, can substitute for certain aspects of this experience. The key to a successful safety and health training effort is through the application of goal-oriented techniques. Adherence to safe operating practices and procedures can normally be assured with the full cooperation of personnel only when there is a clear and defined knowledge of job-related potential hazards and a practical understanding of the strategies necessary to prevent them. This goal can be reached most effectively through a well-developed and coordinated training effort which includes safety and health training for supervisory personnel, employees responsible for conducting safety and health inspections, all members of safety and health committees (where established), and other employees.

Your occupational safety and health (OSH) training programs must be designed in a manner which will instruct individual employees in the performance of their work in a safe environment and should be developed appropriate to the responsibility level of the individual. However, as a minimum it must provide personnel with sufficient information for their activity's OSH program. This section provides recommended minimum training to be provided to all categories of personnel. Records must be maintained for 5 years to indicate training provided, list of attendees, and the dates of the training. Record your training sessions on an AF Form 2767 and file it in Tab F of the industrial case file. These forms and the industrial case files will be discussed in detail in the next chapter. Individual employee personnel records should also be annotated to reflect the training received.

Management personnel. Management personnel should receive OSH training to enable them to actively and effectively support OSH programs in their specific areas of responsibility. In addition to coverage of appropriate statutes, regulations, and applicable Air Force safety and health standards, management level training should include:

a. An in-depth examination of management's responsibilities in relation to the activity's OSH programs.

b. Ensuring that an aggressive and continuing OSH program is implemented throughout the activity. Training topics may include analysis of compliance procedures, the study of current accident and injury reporting procedures, and a thorough understanding of inspection/investigation techniques.

c. A review of Air Force policy of all relevant aspects of the AFOSH program.

A sound comprehension of the material addressed in this volume is essential to the implementation of an integrated OSH program at all command levels throughout the Air Force. This includes an examination of program objectives and goals. Typical program goals include:

- The reduction of personnel exposed to hazards by abatement procedures or facilities' correction.
- The promotion of an increased degree of OSH awareness throughout the activity through an effective training program.
- The development and implementation of plans and procedures for evaluating and improving education program effectiveness.

Supervisors and employee representatives. Training for these personnel should include introductory and specialized courses and materials which will enable them to recognize unsafe/unhealthful working conditions and practices in the workplace. For supervisory personnel, training should also include the development of skills necessary to manage the activity's OSH program at the work unit level. These management skills require the knowledge of healthful work practices and involve the integration of occupational safety with job training. Training for supervisory personnel should also include OSH performance measurement, enforcement of AFOSH standards and accident investigation, and the use and maintenance of personal protective equipment. Newly appointed supervisors should receive OSH training within 120 days of their appointment and annual refresher training.

Nonsupervisory personnel. OSH training for nonsupervisory personnel should include specialized job safety and health training appropriate to the work performed by the employees. This specialized training should be directed to the individual's worksite and should include an examination of the relevant AFOSH standards and an analysis of the material and equipment hazards associated with the worksite. Employee training should be conducted with input and direction from the workplace supervisor and should include instructions on employee rights and responsibilities pursuant to relevant OSH statutes, regulations, and the AFOSH program. Arrangements should be made to provide training to all new personnel as close to the time of assuming their responsibilities as possible. Initial training requirements for new employees should include:

a. Command and/or local policy on occupational health education.

b. Work unit policy on occupational safety and health.

c. Individual responsibility for safety and health.

d. Employee reporting procedures for hazardous operations/conditions.

e. Awareness of hazards common to the individual worksite, trade, occupation, or task.

f. First aid/cardiopulmonary resuscitation training for personnel who will be exposed to electrical shock, hazardous materials, or operations which could result in loss of heart or lung function.

Sources of Information. There are OSH educational and promotional materials such as posters, films, technical publications, pamphlets, and related materials that can be beneficial in the reduction and prevention of workplace related accidents and illnesses. These should be maintained and subscribed to as an integral element of the AFOSH program.

Reference library. You should maintain a suitable safety and health reference library appropriate to the size and functions of your base.

Occupational health education programs. Many occupational health educations programs (see Appendix A) are available through your audiovisual library at your base. Many more are in development at the School of Aerospace Medicine, Brooks AFB, Texas. See your base film library for a listing of the latest educational programs available. These training packages can serve as excellent tools to get your occupational health education programs started.

Other health services. Additionally, you can refer to several agencies such as National Institute for Occupational Safety and Health (NIOSH); Centers for Disease Control (CDC); U.S. Public Health Services (USPHS), and even your local health department to help you get information for your training programs.

Hazardous Material Information System (HMIS). Many different materials are used in workplaces throughout the Air Force, some of which are hazardous. A key element of the program is to inform workers about these hazards and the measures necessary to control them. Past efforts to accomplish this objective have been complicated by the fact that most of these materials are purchased under a trade name or simply a stock number, and in many cases container labels do not provide adequate information relative to their hazardous properties. Therefore, the Department of Defense (DOD) has established the Hazardous Material Information System (HMIS) which is designed to acquire, store, and disseminate data on hazardous materials procured for use.

The HMIS provides a mechanism for the systematic compilation/ distribution of information on all hazardous materials procured by DOD. This organized information is intended for use throughout the DOD in:

- Developing procedures to prevent mishaps in handling, storage, use, transportation, and disposal of hazardous materials.
- Advising DOD personnel of the hazards associated with specific materials encountered in their workplaces.
- Devising environmentally acceptable hazardous material disposal procedures.

The manager of the DOD HMIS is the Defense Logistics Agency (DLA). The DLA is responsible for maintaining a computerized central repository of data on all hazardous material purchased for use by DOD. The basic vehicle for documenting this data is the Material Safety Data Sheet (fig. 1-9) obtained from the supplier of the hazardous material. This information should be located in your bioenvironmental engineering services office and will serve as an excellent source of information when you are designing your health education briefings.

Other material. Various periodicals (such as the *Occupational Safety and Health Reporter*, published by the Bureau of National Affairs, Inc.); magazines (e.g., *Navy Lifeline*, published by the Naval Safety Center); texts; other publications (e.g. *Occupational Hazards*, which is usually available at no cost from 111 Chester Ave., Cleveland Ohio 44114); and applicable portions of the *Federal Register* will be helpful in updating information for your training programs.

Exercises (206):

1. What is the major purpose of your health education programs?

2. How long should records of training be maintained and where are they kept?

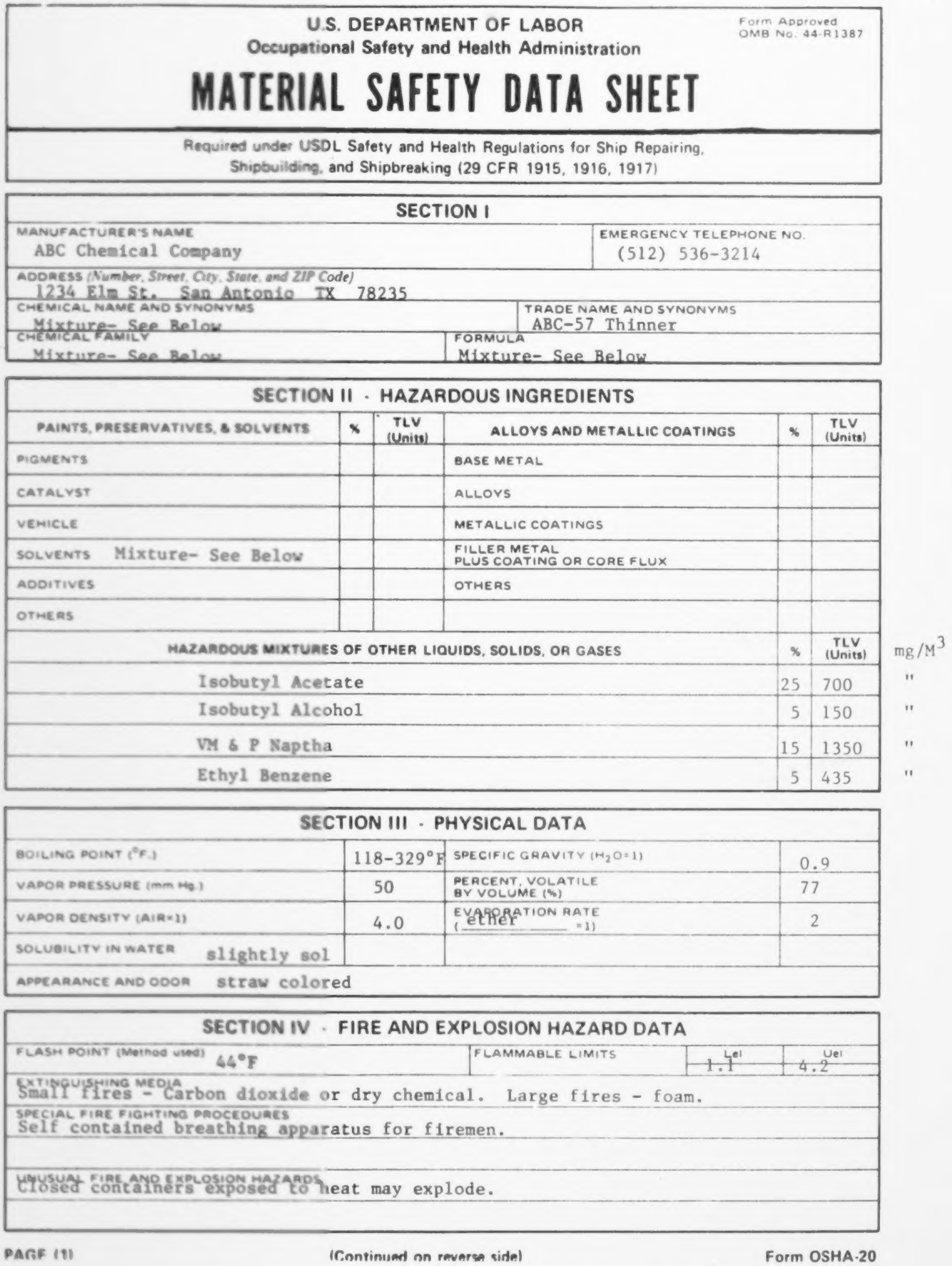
3. What three things should management level training include?

4. What should training of supervisors and employee representatives contain?

5. List initial training requirements for new employees.

6. Where can you go for further information on occupational hazards?

7. What is the HMIS system?



U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: ABC Chemical Company
EMERGENCY TELEPHONE NO.: (512) 536-3214
ADDRESS *(Number, Street, City, State, and ZIP Code)*: 1234 Elm St. San Antonio TX 78235
CHEMICAL NAME AND SYNONYMS: Mixture- See Below
TRADE NAME AND SYNONYMS: ABC-57 Thinner
CHEMICAL FAMILY: Mixture- See Below
FORMULA: Mixture- See Below

SECTION II · HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS Mixture- See Below			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)	mg/M^3
Isobutyl Acetate	25	700	"
Isobutyl Alcohol	5	150	"
VM & P Naptha	15	1350	"
Ethyl Benzene	5	435	"

SECTION III · PHYSICAL DATA

BOILING POINT (°F.)	118-329°F	SPECIFIC GRAVITY (H_2O=1)	0.9
VAPOR PRESSURE (mm Hg.)	50	PERCENT, VOLATILE BY VOLUME (%)	77
VAPOR DENSITY (AIR=1)	4.0	EVAPORATION RATE (ether =1)	2
SOLUBILITY IN WATER slightly sol			

APPEARANCE AND ODOR: straw colored

SECTION IV · FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
44°F		1.1	4.2

EXTINGUISHING MEDIA: Small fires - Carbon dioxide or dry chemical. Large fires - foam.
SPECIAL FIRE FIGHTING PROCEDURES: Self contained breathing apparatus for firemen.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Closed containers exposed to heat may explode.

PAGE (1)

(Continued on reverse side)

Form OSHA-20

Figure 1–9. Sample, OSHA Form 20 (front).

SECTION V · HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Mixture

EFFECTS OF OVEREXPOSURE
Anesthesia, irritation of respiratory tract, acute nervous system depression, eye and skin irritation.

EMERGENCY AND FIRST AID PROCEDURES
In case of contact, flush skin and eyes with water and remove contaminated clothing. If inhaled, remove to fresh air. Call a physician if conditions persist.

SECTION VI · REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Avoid fire, heat, and hot surfaces.

INCOMPATABILITY *(Materials to avoid)*
None

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII · SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Remove all sources of ignition (hot surfaces, and electrical static or frictional sparks). Avoid breathing vapor. Remove with inert absorbent and non-sparking tools.

WASTE DISPOSAL METHOD
Dispose in accordance with local, state, and federal regulations. Do not incinerate closed containers.

SECTION VIII · SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Use NIOSH approved paint respirator or air supplied respirator.

VENTILATION	LOCAL EXHAUST As necessary, depending on use.	SPECIAL
	MECHANICAL *(General)* As necessary, depending on use.	OTHER Consult an industrial hygienist.

PROTECTIVE GLOVES Required.	EYE PROTECTION Required.

OTHER PROTECTIVE EQUIPMENT
Ear protection may be needed if material is sprayed. Consult an industrial hygienist.

SECTION IX · SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Do not store above 120°F.

OTHER PRECAUTIONS
Store large quantities in buildings designed for storage of NFPA Class 1 flammable liquids.

PAGE (2)
GPO 930-540

Form OSHA-20
Rev. May 72

Figure 1–9. Sample, OSHA Form 20 (back).

Standardized Occupational Health Program

THE AIR FORCE Medical Service has been conducting occupational health programs for over two decades. Until the Occupational Safety and Health Act (OSHA) of 1970, occupational health, with its two components—industrial hygiene and occupational medicine—was a low-priority program. Today with the complexity of new legislations and developments, the Air Force has developed the Comprehensive Occupational Health Surveillance Program (COHSP). This consolidated industrial hygiene/occupational data base has been established to provide complete human profiles. Therefore, group trends can be readily identified and timely preventive intervention instituted. This data base, coupled with classical biological effect studies, will also serve as a pool of information to develop regulations and Air Force standards.

This new approach to occupational health within the Air Force will not only fulfill the legal obligations to provide a safe and healthful working environment, but reaffirms the long-standing commitment of the Air Force to protect its most valuable resource—people. As an environmental health specialist, you play a major role in this commitment. Through the six subprograms of COHSP, you and the bioenvironmental engineering specialists obtain an ultimate goal of providing Air Force workers with a healthful working environment in which chemical, physical, or biological hazards are reduced below levels that cause, or are likely to cause, illness or injury. COHSP has six subprograms:

a. The Standardized Occupational Health Program (SOHP). This is a standardized base-level manual data storage system. Occupational areas throughout the Air Force have been uniquely coded with a workplace identifier, similar to a Social Security number for an individual. Using the workplace identifier, data can now be stored and retrieved by base, organization, and functional area.

b. Computerized Occupational Health Program (COHP). This is an automated system to store and manage worker and workplace exposure data. This system will include individual minicomputers at local Air Force bases and a central host computer for long-term storage and retrieval.

c. Detection Equipment Capabilities and Technologies (DETECT)/Protective Equipment Capabilities and Technologies (PROTECT) Programs. These elements address the evaluation and selection of sampling procedures and instrumentation (DETECT) and personal protective equipment (PROTECT) commonly found in the industrial workplace.

d. Toxicological Research and Epidemiology of Noise and Dangerous Substances (TRENDS)/Computerized Assessment of Radiation Exposure (COMPARES) Programs. These elements address toxicological responses to dangerous chemical substances and the physiological responses to noise and radiation.

These six COHSP subprograms will provide for efficient flow of occupational health information to and from all professionals involved. This flow will be significantly enhanced by the standardization and automation of all relevant industrial hygiene, occupational medicine, and environmental data.

When you complete this chapter, you should know the purpose, objectives, scopes, and functions of the Standardized Occupational Health Program. You should have a thorough understanding of the duties of the environmental health section and those of the bioenvironmental engineering section and how these duties interrelate and fit into the overall environmental health programs. First, let's start by looking at the requirements for medical examinations, then the facets of the Standardized Occupational Health Program.

2-1. Requirements for Medical Examinations

To ensure that our objectives and goals—to protect the worker—are met, the Bioenvironmental Engineering Services (BES) begins by performing surveillance activities of the workplace. As you will see later, the information gathered during this phase will be provided to Environmental Health Services (EHS) for your coordination and action under the clinical occupational Health Surveillance portion of the program. As mentioned earlier, this program consists of both worker (EHS responsibility) and workplace (BES responsibility) surveillance activities. Workplaces must be surveyed to identify all potential exposures and these must, in turn, be investigated to establish a complete workplace exposure profile so that worker exposure can be determined and you have the necessary information to design an occupational physical that will monitor the effects of that exposure on the worker.

207. State the requirements for receiving medical examinations.

Directives. The base or supporting medical facility is responsible for medical examination of personnel occupationally exposed to the chemical substances listed in

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AFOSH Standard 161-17, *Standardized Occupational Health Program*. (Keep in mind, additional toxic materials may be present in the workplace that are not part of this list.) The Aerospace Medicine Council determines the type, frequency, and extent of examinations required based on the guidance contained in existing Air Force directives such as AFR 161-33, *The Aerospace Medicine Program*, or substance-specific AFOSH standards and the results of industrial hygiene surveys. The selection of relevant medical tests or clinical examination procedures may not be possible for some exposure situations. If medical examinations are deemed inappropriate or to have little value in determining the significance of an occupational exposure, the reasoning that was used to make this decision should be documented in the shop case files. Where specific guidance is not available, the following guidelines are applied.

Conditions. Medical examinations are not required unless at least one of the following conditions exists:

a. Personnel are being protected from exposures exceeding permissible exposure limits (PEL's) by the use of respirators.

b. Personnel are being exposed to 8 hour time-weighed average (TWA) concentrations exceeding one-half the PEL, or significant concern exists because of potential skin absorption.

c. Personnel exhibit signs or symptoms which may be reasonably attributed to the type exposures involved.

d. Personnel known to be exposed above PELs or who had skin contact with substances having a "skin" notation during emergencies, accidents, etc.

Types of Tests. If medical examinations are required, they should as a minimum include:

a. Baseline and periodic (at least annual) examinations.

b. A complete medical and chemical exposure history.

c. A biological indicator of exposure if one exists (e.g., a test to measure the level of lead in the urine or blood).

d. Only those diagnostic tests or clinical examination procedures required to detect changes in target organs of the chemical exposure involved.

Recordkeeping. You should maintain records of exposure results and medical examinations in accordance with AFR 161-33, AFR 168-4, and AFR 12-50, as appropriate.

Exercises (207):

1. When you determine that an occupational exposure can't be monitored by medical tests, what must you do?

2. State four requirements for medical examinations.

3. Briefly state the types of tests included in occupational physicals.

4. In which Air Force directives can you find information on maintaining records for medical examinations?

2-2. Scope of the Standardized Occupational Health Program

The purpose of this program is to implement base-level surveillance and records management provisions of DOD Instruction 6055.5, Industrial Hygiene and Occupational Health, April 30, 1980. It establishes standardized procedures that will allow for the uniform recording of workplace and worker exposure data and the formatting of data to allow trend analysis and epidemiological investigations. Additionally, this program is designed for the early identification of potential health risk to allow timely preventive intervention and to minimize any adverse impacts on the Air Force mission effectiveness.

The objective of the program is to protect the worker—both military and civilian personnel (including foreign nationals)—by providing a work environment that is free of recognized chemical, physical, or biological health risks. The success of this program is an essential contribution to our country's overall military readiness.

208. State how the Standardized Occupational Health Program protects worker health and the Air Force mission.

Worker Health. Failure to provide a healthful environment can affect the worker in two general ways. First, short-term acute illness can cause unacceptable losses in productivity. Second, and more insidious, are long-term chronic exposures that cause gradual impairments, such as hearing losses. When these effects are discovered, the Air Force not only loses the worker's productivity but also the experience base the worker has developed over many years—a commodity very difficult to replace. Air Force illness and injury costs rose to $62.4 million for worker compensation in 1980. In this day and age of "doing more with less" within the military system, one can see that a great effort on your part, as environmental health professionals dedicated to protecting the worker, is an extremely important mission.

Mission Impact. Until modern times, military medicine was primarily concerned with treating wounded soldiers so that they could fire their weapons and remain an effective fighting force. However, to operate high-performance aircraft and sophisticated missile systems and maintain these systems, our airmen must be in top physical and mental condition. Your primary emphasis, then, must be prevention of disease and injury and promotion of health. The concept of environmental health is not new, but whether it is put into practice often spells success or failure to the military operation in time of war or in peace. Although less glamorous than the treatment of medical or surgical emergencies, activities in environmental medicine programs have contributed more to the overall USAF mission than any other single medical element.

Exercises (208):

1. If we don't provide a healthy working environment for our industrial workers, what two ways may their health be affected?

2. How do the effects of an unhealthy work environment affect the mission?

3. What should be your primary emphasis in protecting worker health?

209. Describe the surveillance activities and identify forms of the Standardized Occupational Health Program.

Surveillance of Workplace. To protect workers' health, the workplace must be evaluated for many types of hazards. The Standardized Occupational Health Program has four types of surveillance activities: industrial hygiene, chemical, physical, and biological surveillance programs.

Industrial hygiene surveillance. To ensure that our objectives and goals of the program are met, the BES begins by performing surveillance activities of the workplace. The information gathered during this phase is provided to the EHS. This portion of the overall Comprehensive Occupational Health Surveillance Program has as its chief goal the preservation and, if possible, the improvement of the health of the work force. The industrial hygiene surveillance phase begins with the industrial hygiene survey of all Air Force workplaces.

The industrial hygiene surveys are required because occupational environmental stresses must be recognized and evaluated to establish complete workplace exposure profiles before they can be controlled. Documentation of these activities is made using the applicable Standardized Occupational Health Program forms. The bioenvironmental engineer (BEE) begins with a comprehensive base line study of each workplace. Such studies include a detailed assessment of the operation performed, including specific risks, available control measures, and an evaluation of the effectiveness of such measures. Consideration is also given at that time to the interrelationships of chemical, physical, biological, and biomechanical stresses that may exist in any industrial environment. The BEE determines at this time if the workplace should be placed on the annual re-survey list. If so, the BEE annually thereafter performs an industrial hygiene survey of the workplace. Additionally, the BEE later (normally in 6 months) revisits the workplace to conduct a periodic survey to determine the adequacy of actions taken to correct potentially unhealthy conditions noted on the baseline survey as well as to check the continuing effectiveness of, or the need for, other control measures and to evaluate any new or changing operations. Finally, the BEE may perform an unscheduled survey. This is a special survey initiated by the BEE or by a request for an occupational medicine consultation. This request may be submitted by a medical practitioner, a supervisor, an employee representative or employee, or you, if a threat to worker health is suspected or if there is reason to believe proper procedures are not being practiced. When potential or actual health risks are identified during any of these surveys, you should be notified to make sure that proper medical monitoring of affected workers is done.

The health of the potentially or actual exposed worker should then be simultaneously monitored by conducting occupational health examinations that may include worker histories, biological screening, and physical examinations.

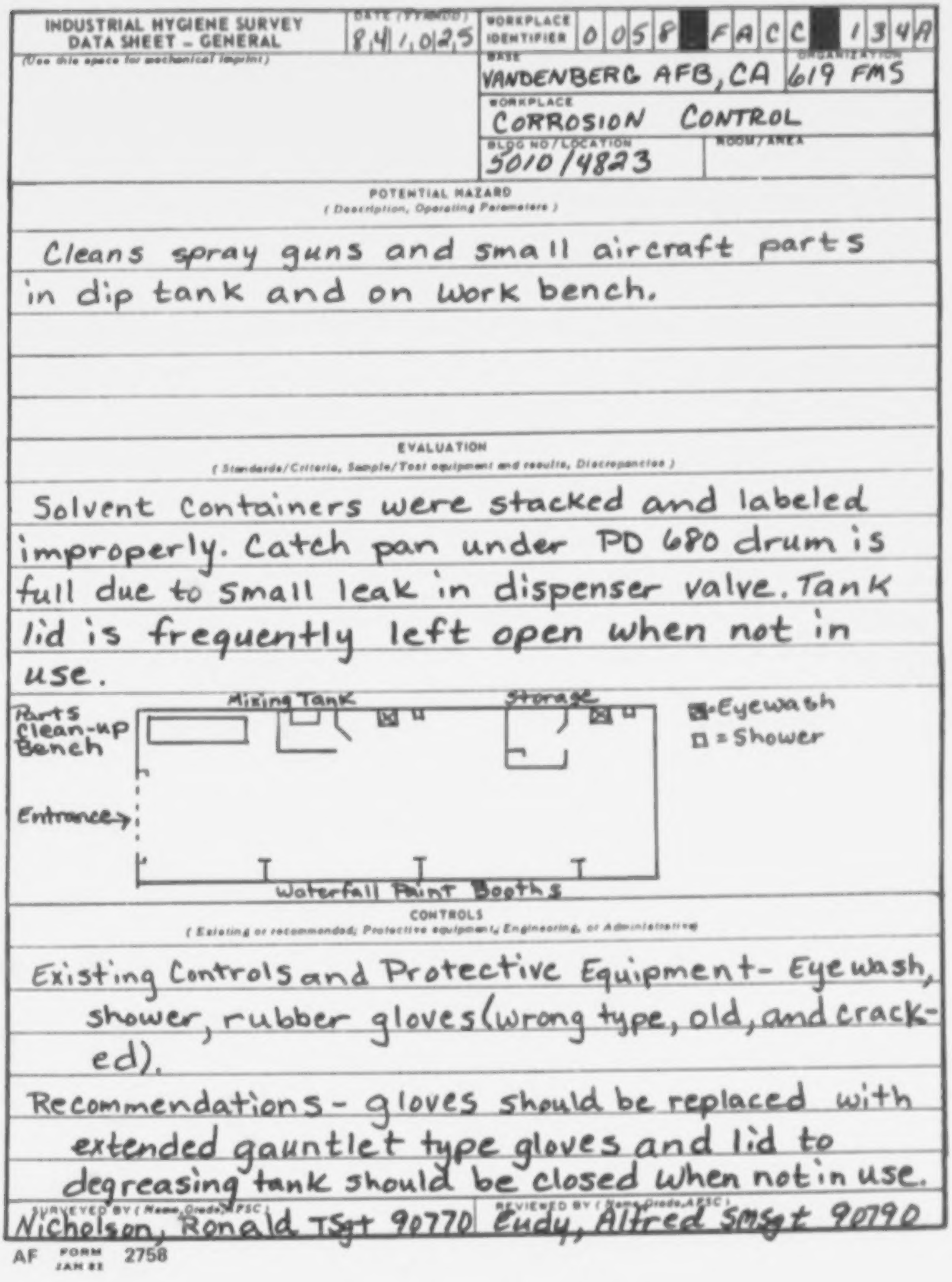
Chemical agent exposure surveillance. Every industrial workplace is unique because of the wide range of tasks performed, materials/equipment used, and facilities occupied. As a result, rigid medical surveillance procedures cannot be specifically stated. A generalized survey process sequence, however, can be followed. This process has three phases: recognition, evaluation, and control. These phases are used by the BES as a process guide for their chemical exposure surveillance.

Recognition. The bioenvironmental engineering section must become familiar with the tasks being performed in the workplace through observations, interviews, and review of case files and health records. This phase also includes a list of materials used, entered on AF Form 2761, Hazardous Materials Data. The recognition phase is completed with a decision as to which potential exposures require detailed special survey evaluations.

Evaluation. If an inhalation risk is possible and a valid prediction as to exposure level cannot be made, air samples are taken and the results are documented on the AF Form 2750, Industrial Hygiene Sampling Data, and AF Form 2762, Listing of Industrial Hygiene Survey Results. If an absorption, ingestion, or skin contact risk is possible, an evaluation of work *practices* is made to include such things as the wear and maintenance of protective equipment and the sanitation of latrines and break areas. AF Form 2758, Industrial Hygiene Data Sheet - General (fig. 2-1), is used to record this information. If there are existing industrial ventilation systems, they too must be evaluated.

Control. If the evaluations reveal exposures at or in excess of the permissible exposure limits, further controls must be considered. These controls can be classified as engineering, administrative, and personal protective equipment. All of the existing and recommended controls are recorded on AF Form 2758. If the personal protective equipment involves respirators, EHS records the fit testing and education of workers on AF Form 2767, Occupational Health Training and Protective Equipment Fit Testing.

Postsurvey procedures. The results of survey activities, which have been recorded on the specific SOHP forms, are filed in the appropriate tab of the case file. Progress on implementing recommendations and any other correspondence is recorded on AF Form 2754, Chronological Record of Workplace Surveillance. A second postsurvey report is the annual Master Workplace Exposure Data Summary, AF Form 2755. It is used by the Aerospace Medicine Council to determine any occupational



INDUSTRIAL HYGIENE SURVEY DATA SHEET – GENERAL

DATE (YYMMDD): 841025

WORKPLACE IDENTIFIER: 0058 FACC 134A

(Use this space for mechanical imprint)

BASE: VANDENBERG AFB, CA

ORGANIZATION: 619 FMS

WORKPLACE: CORROSION CONTROL

BLDG NO/LOCATION: 5010/4823

ROOM/AREA:

POTENTIAL HAZARD
(Description, Operating Parameters)

Cleans spray guns and small aircraft parts in dip tank and on work bench.

EVALUATION
(Standards/Criteria, Sample/Test equipment and results, Discrepancies)

Solvent Containers were stacked and labeled improperly. Catch pan under PD 680 drum is full due to small leak in dispenser valve. Tank lid is frequently left open when not in use.

CONTROLS
(Existing or recommended; Protective equipment, Engineering, or Administrative)

Existing Controls and Protective Equipment - Eyewash, shower, rubber gloves (wrong type, old, and cracked).

Recommendations - gloves should be replaced with extended gauntlet type gloves and lid to degreasing tank should be closed when not in use.

SURVEYED BY (Name, Grade, AFSC): Nicholson, Ronald TSgt 90770

REVIEWED BY (Name, Grade, AFSC): Eudy, Alfred SMSgt 90790

AF FORM JAN 82 2758

Figure 2-1. Sample, AF Form 2758.

health examination requirements and to summarize the worker exposures in the health record.

Physical agent exposure surveillance. The generalized recognition process is basically the same as for chemical exposure surveillance. Therefore only the specified recognition forms will be identified:

- AF Form 2759, Radio Frequency Emitter Survey.
- AF Form 2760, Laser Hazard Evaluation.
- DD Form 2214, Noise Survey.
- AF Form 1622, Engineering Noise Survey.
- AF Form 2758, Industrial Hygiene Survey Data Sheet General.
- AF Form 2757, Illumination Survey Data Sheet.

Evaluation. Two types of evaluations are used by the BES for physical agent exposure. They are mathematical predictions and actual measurements. The BES may use actual measurements to verify their mathematical predictions. Then they will use the forms for evaluation data as for the recognition phase.

Control. BES ensures that physical agent exposures exceeding the permissible exposure limits are reduced by the use of engineering or administrative controls or appropriate personal protective equipment. These controls are recorded on the applicable survey form. For example, if hearing protection is required, EHS records fit testing and worker education on the AF Form 2767.

Biological agent exposure surveillance. BES places a lot of emphasis on preventive controls in this area because a proper evaluation of the workers exposure is usually difficult. There are few potential exposures to biological agents found in Air Force workplaces. However, if a risk is present, the biological agent data must be recorded on AF Form 2758.

Exercises (209):

1. Why are industrial hygiene surveys conducted?

2. What do the "comprehensive baseline surveys" of industrial workplaces include?

3. Why does the BEE perform periodic surveys?

4. Who can request a special survey?

5. What are the three phases of chemical exposure surveillance?

6. If an absorption, ingestion, or skin contact risk is possible, what type of evaluation of the work area is made?

7. Where do you record fit testing information and occupational health education training?

8. What is the *main* form used to determine occupational health examination requirements and to summarize worker exposures in the health record?

210. Describe the sections found in the industrial case files.

Case Files. As the BES completes these surveys and records the data on the applicable SOHP forms, the forms are placed into the workplace case file. This file can be used by EHS and other agencies to provide a complete picture of the workplace and the hazards located there. The case file is to a workplace as a medical record is to a worker. Those workplaces where no significant physical, chemical, or biological exposures are identified are usually put together in one file to cover an entire building or facility.

Coding systems. Each case file must be uniquely identified with a descriptor equivalent to a worker's Social Security number. That descriptor is called the workplace identifier (WI) (fig. 2-2). The WI consists of three sets of four digits. The first set of four digits designates the base where the workplace is located. The middle set of digits designates the type of organization (e.g., hospital, aircraft maintenance, civil engineering) and the work function (e.g., welding, painting, carpentry). The last set of digits designates the numerically sequenced case file number, locally assigned by the base BEE. The WI is used on all forms governed by the Standardized Occupational Health Program. When a form is used that does not have an entry space for the WI, the code will be entered in the upper left margin of the form. The major advantage of this unique, universal WI system is that data can be stored, sorted, retrieved manually, or in a future automated repository.

Recordkeeping. The actual contents of the six case file tabs can now be examined.

Tab A. Tab A will contain only one type of form, AF Form 2754, Chronological Record of Workplace Surveillance (fig. 2-3). This form is the workplace equivalent to the SF 600, Chronological Record of Care, found in every Air Force medical record. Its purpose is to maintain a handwritten record of all actions involving surveillance of the workplace. Examples are entries for base line, annual, and special surveys and telephone conversations and informal visits. Each entry should be brief (refer to other tabs if necessary) and be dated and signed.

Tab B. Tab B is called Master Summary and Correspondence. This tab will contain outputs generated by data in the other tabs. There are two distinct outputs. The first is AF Form 2755, Master Workplace Exposure Data Summary (fig. 2-4). It is prepared by gathering the final results of the other physical and chemical exposure

WORKPLACE IDENTIFIER

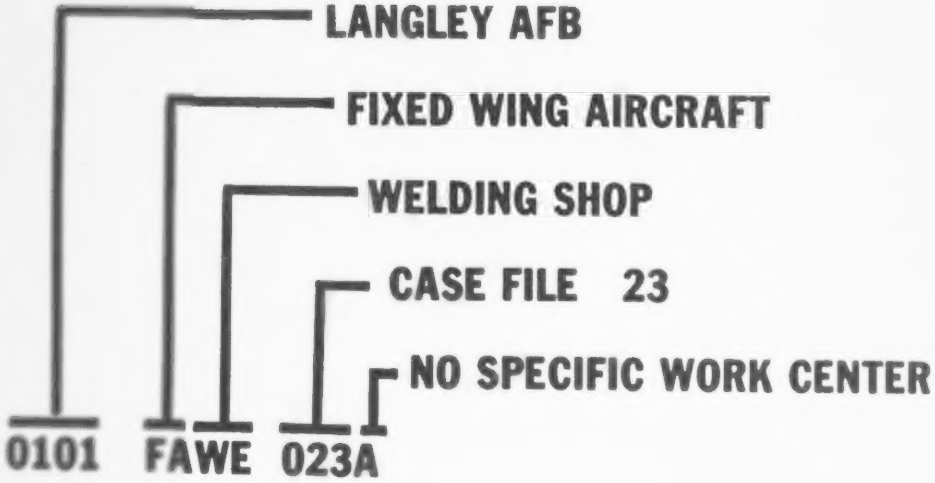
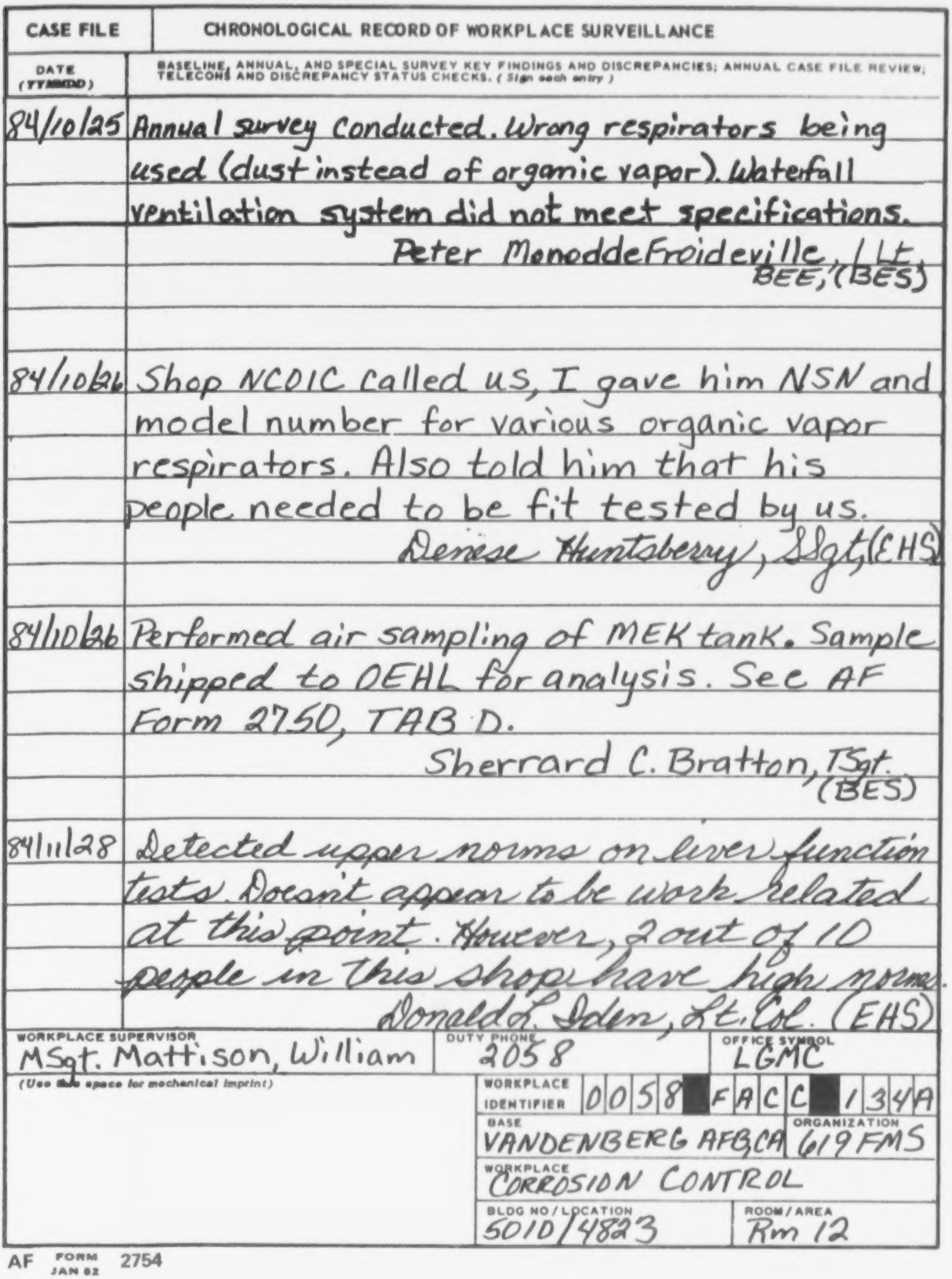


Figure 2–2. Workplace identifier (WI) codes.



CASE FILE | **CHRONOLOGICAL RECORD OF WORKPLACE SURVEILLANCE**

DATE (YYMMDD)	BASELINE, ANNUAL, AND SPECIAL SURVEY KEY FINDINGS AND DISCREPANCIES; ANNUAL CASE FILE REVIEW; TELECONS AND DISCREPANCY STATUS CHECKS. *(Sign each entry)*
84/10/25	Annual survey Conducted. Wrong respirators being used (dust instead of organic vapor). Waterfall ventilation system did not meet specifications. Peter MonoddeFroideville, 1Lt, BEE, (BES)
84/10/26	Shop NCOIC called us, I gave him NSN and model number for various organic vapor respirators. Also told him that his people needed to be fit tested by us. Denise Huntsberry, SSgt, (EHS)
84/10/26	Performed air sampling of MEK tank. Sample shipped to OEHL for analysis. See AF Form 2750, TAB D. Sherrard C. Bratton, TSgt. (BES)
84/11/28	Detected upper norms on liver function tests. Doesn't appear to be work related at this point. However, 2 out of 10 people in this shop have high norms. Donald L. Iden, Lt. Col. (EHS)

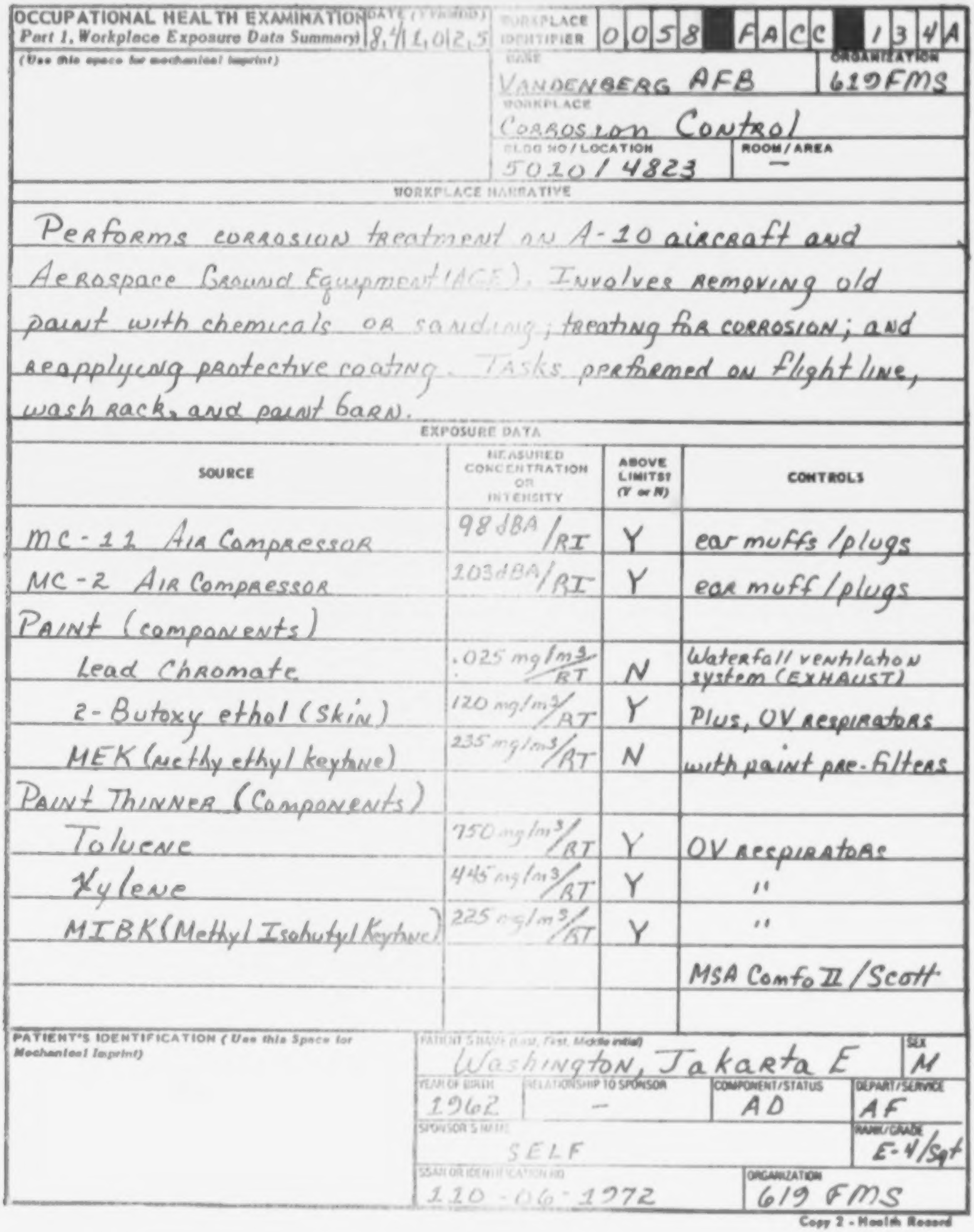
WORKPLACE SUPERVISOR: MSgt. Mattison, William
DUTY PHONE: 2058
OFFICE SYMBOL: LGMC

(Use this space for mechanical imprint)

WORKPLACE IDENTIFIER: 0058 FACC 134A
BASE: VANDENBERG AFB, CA
ORGANIZATION: 619 FMS
WORKPLACE: CORROSION CONTROL
BLDG NO/LOCATION: 5010/4823
ROOM/AREA: Rm 12

AF FORM JAN 82 2754

Figure 2-3. Sample, AF Form 2754.



OCCUPATIONAL HEALTH EXAMINATION
Part 1, Workplace Exposure Data Summary

DATE (YYMMDD): 841025

WORKPLACE IDENTIFIER: 0058 FACC 134A

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BASE	VANDENBERG AFB
ORGANIZATION	619FMS
WORKPLACE	Corrosion Control
BLDG NO/LOCATION	5010 / 4823
ROOM/AREA	—

WORKPLACE NARRATIVE

Performs corrosion treatment on A-10 aircraft and Aerospace Ground Equipment (AGE). Involves removing old paint with chemicals or sanding; treating for corrosion; and reapplying protective coating. Tasks performed on flight line, wash rack, and paint barn.

EXPOSURE DATA

SOURCE	MEASURED CONCENTRATION OR INTENSITY	ABOVE LIMITS? (Y or N)	CONTROLS
MC-11 Air Compressor	98 dBA/RT	Y	ear muffs/plugs
MC-2 Air Compressor	103 dBA/RT	Y	ear muff/plugs
Paint (components)			
Lead Chromate	.025 mg/m3/RT	N	Waterfall ventilation system (EXHAUST)
2-Butoxy ethol (Skin)	120 mg/m3/RT	Y	Plus, OV respirators
MEK (methy ethyl keytone)	235 mg/m3/RT	N	with paint pre-filters
Paint Thinner (Components)			
Toluene	750 mg/m3/RT	Y	OV respirators
Xylene	445 mg/m3/RT	Y	"
MIBK (Methyl Isobutyl Keytone)	225 mg/m3/RT	Y	"
			MSA Comfo II/Scott

PATIENT'S IDENTIFICATION (Use this Space for Mechanical Imprint)

PATIENT'S NAME (Last, First, Middle initial)	Washington, Jakarta E
SEX	M
YEAR OF BIRTH	1962
RELATIONSHIP TO SPONSOR	—
COMPONENT/STATUS	AD
DEPART/SERVICE	AF
SPONSOR'S NAME	SELF
RANK/GRADE	E-4/Sgt
SSAN OR IDENTIFICATION NO	110-06-1972
ORGANIZATION	619 FMS

Copy 2 - Health Record

Figure 2-4. AF Form 2755, Model Workplace Exposure Data Summary

evaluation forms. The original is filed in Tab B, but the copy becomes part of each worker's AF Form 2100 series, Health Record. This firmly establishes the required link between workplace and worker surveillance and furnishes the health care provider and EHS personnel with a concise summary of the individual's workplace exposures. The second item is the correspondence, either a survey letter or report, sent to the workplace supervisor detailing survey findings and recommendations to correct discrepancies.

Tab C. Tab C is the Physical Agent Exposure Data. All physical exposure related data, including noise, lighting, thermal stress, and radiation will be filed in this tab.

Tab D. Tab D is the Chemical Exposure Data. This tab is the most complex section of the case file. It tracks chemicals using the "cradle-to-grave" concept. AF Form 2761, Hazardous Materials Data (fig. 2-5), will provide the listing of all potentially hazardous materials found in the workplace, usage, and disposal methods. AF Form 2750, Industrial Hygiene Sampling, will also be found in this tab. It lists all the complex air sampling requiring laboratory analysis and will note all the instrument calibration and sample collection data and the summarized analysis results. This provides a convenient place for tabulating multiple analysis results so that easy comparisons with existing standards can be made. Additionally, any data forms that contain information relevant to ventilation surveys and chemical pollution control will also be filed under this tab.

Tab E. In Tab E, you will find the Miscellaneous and Special Operations Data. This tab has been designated for storage of miscellaneous data which includes biological hazards, process flow documents, standard operating procedures (SOP's) etc.

Tab F. Tab F is the Clinical Occupational Health Data. Data such as consultative and toxicological exposure reports pertaining to the health of an individual worker will be filed here (such as SF 513, Clinical Record Consultation Sheet; AF Form 190, Occupational Illness/Injury Report; and Occupational Verification Rosters). Public access to Tab F contents will be limited to two forms. One is the AF Form 2767, Occupational Health Training and Personal Protective Equipment Fit Testing (fig. 2-6), which will be used for those fit-testing and training programs for which the BEE and Environmental Medicine Service have primary responsibility. The other form, AF Form 2766, Clinical Occupational Health Examination Requirements (fig. 2-7), will specify the extent and frequency of occupational health examinations for the workplace as determined by the Aerospace Medicine Council.

The case file provides the information necessary for decisionmaking, provides for easy retrieval of information, and links the workplace surveillance conducted by the BES and the worker surveillance conducted by the Environmental Health Service.

Exercises (210):

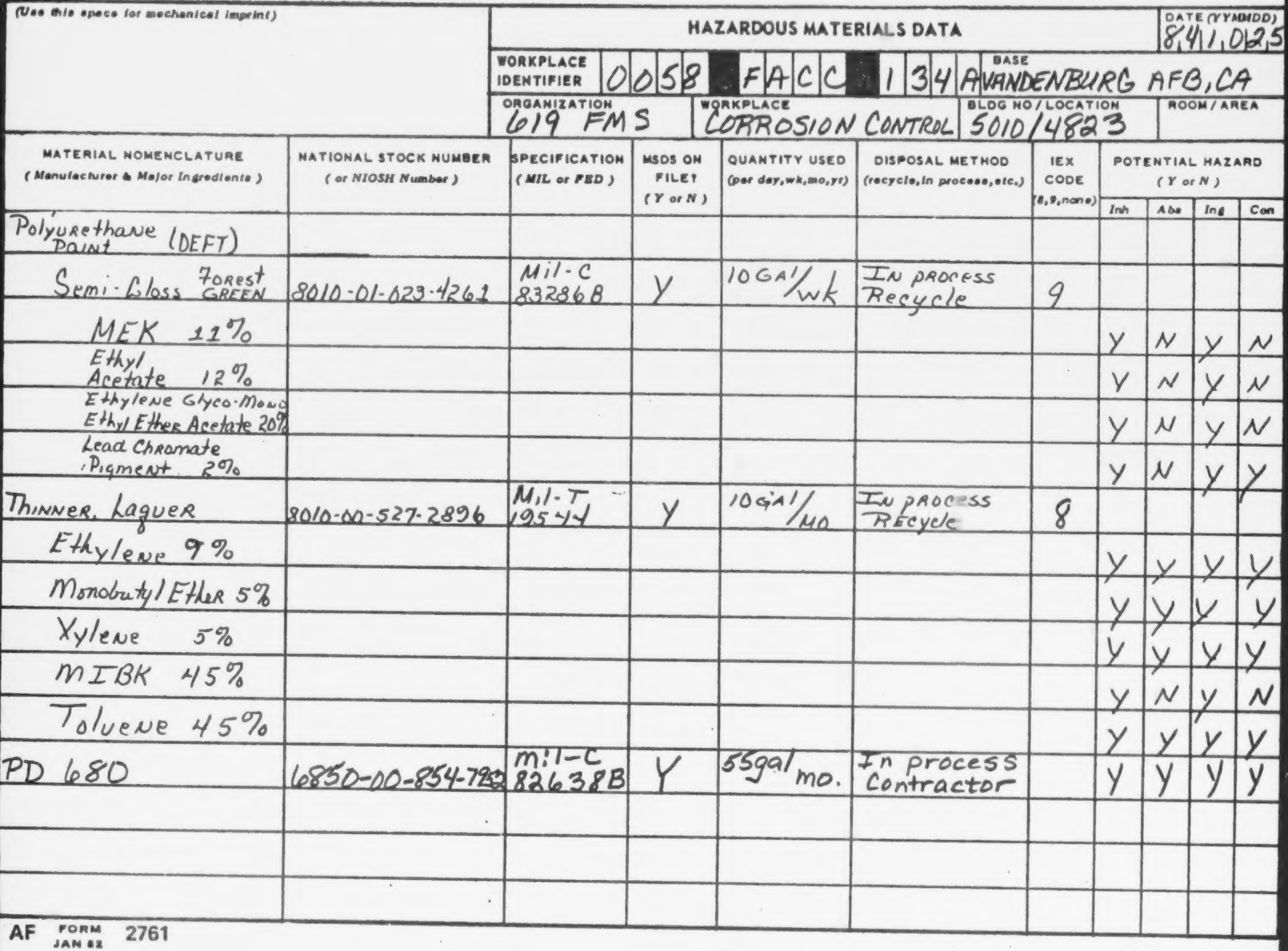
1. In which tab of the industrial case file would you find the AF Form 2755, Master Workplace Exposure Data Summary?
2. What is the purpose of the AF Form 2754, Chronological Record of Workplace Surveillance, and where is it filed in the industrial case file?
3. Where in the industrial case files might you find information on biological hazards present in the work area?
4. What type of information is included in Tab F?
5. How is public access to Tab F limited?

211. Identify the types of occupational health examinations and cite procedures for scheduling and processing these examinations.

Clinical Occupational Health Surveillance. The passage of the Occupational Safety and Health Act (OSHA Act) of 1970 has had a gradually expanding impact on USAF occupational safety and health programs. Initially, Government agencies, including the USAF, maintained parallel but separate programs that utilized standards consistent with those promulgated by the Department of Labor (DOL) for private industry. Despite these efforts, Federal workman's compensation benefits rose to an estimated $1 billion for 1980. A major change in program direction occurred when Executive Orders (EO) 16196 and 1223, Occupational Safety and Health Programs for Federal Employees, were signed on 26 February and 30 June 1980. Federal agencies are now required to comply with the same, not just consistent, standards as private industry. Although an exemption has been granted to military personnel and uniquely military equipment, systems, and operations, the large USAF civilian work force is covered by the 1980 EOs and the Department of Defense (DOD) Instructions (DODI) 6055.5 and DOD Manual 6055.5.

Types of examinations. Based on the results of industrial hygiene surveys of the work environment, review of previous occupational health experience, and applicable directives, the USAF administers occupational health medical surveillance examinations to both military and civilian workers as determined (frequency and scope) by the Aerospace Medicine Council. There are three basic types of occupational physical examinations: preplacement, periodic, and termination.

Preplacement or base line. Preplacement or base line occupational physicals are specific tests and examinations done to establish physical capabilities and limitations in relation to job requirements and to document baseline data for future use in the evaluation of potential exposures.



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HAZARDOUS MATERIALS DATA

DATE (YYMMDD) 841025

WORKPLACE IDENTIFIER 0058 FACC 134A

BASE VANDENBURG AFB, CA

ORGANIZATION 619 FMS

WORKPLACE CORROSION CONTROL

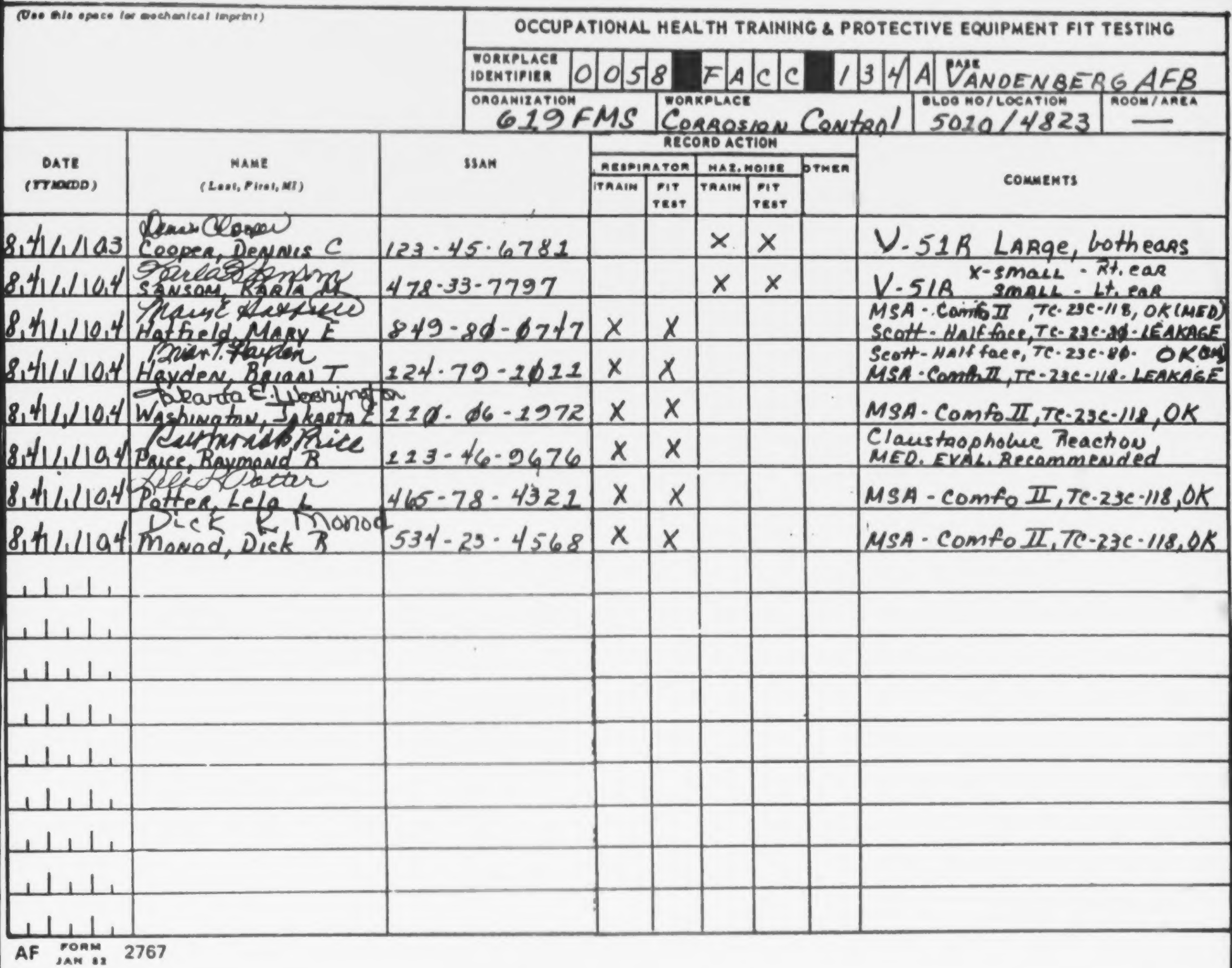
BLDG NO/LOCATION 5010/4823

ROOM/AREA

MATERIAL NOMENCLATURE (Manufacturer & Major Ingredients)	NATIONAL STOCK NUMBER (or NIOSH Number)	SPECIFICATION (MIL or FED)	MSDS ON FILE? (Y or N)	QUANTITY USED (per day, wk, mo, yr)	DISPOSAL METHOD (recycle, in process, etc.)	IEX CODE (8, 9, none)	POTENTIAL HAZARD (Y or N)			
							Inh	Abs	Ing	Con
Polyurethane Paint (DEFT)										
Semi-Gloss Forest GREEN	8010-01-023-4262	Mil-C 83286B	Y	10 GAl/wk	In process Recycle	9				
MEK 11%							Y	N	Y	N
Ethyl Acetate 12%							Y	N	Y	N
Ethylene Glyco-Mono Ethyl Ether Acetate 20%							Y	N	Y	N
Lead Chromate Pigment 2%							Y	N	Y	Y
Thinner, Laquer	8010-00-527-2896	Mil-T 19544	Y	10 GAl/MO	In process Recycle	8				
Ethylene 9%							Y	Y	Y	Y
Monobutyl Ether 5%							Y	Y	Y	Y
Xylene 5%							Y	Y	Y	Y
MIBK 45%							Y	N	Y	N
Toluene 45%							Y	Y	Y	Y
PD 680	6850-00-854-7922	Mil-C 82638B	Y	55gal mo.	In process Contractor		Y	Y	Y	Y

AF FORM JAN 82 2761

Figure 2-5. Sample, AF Form 2761.



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OCCUPATIONAL HEALTH TRAINING & PROTECTIVE EQUIPMENT FIT TESTING

WORKPLACE IDENTIFIER: 0058 FACC 134A

BASE: VANDENBERG AFB

ORGANIZATION: 619 FMS

WORKPLACE: CORROSION CONTROL

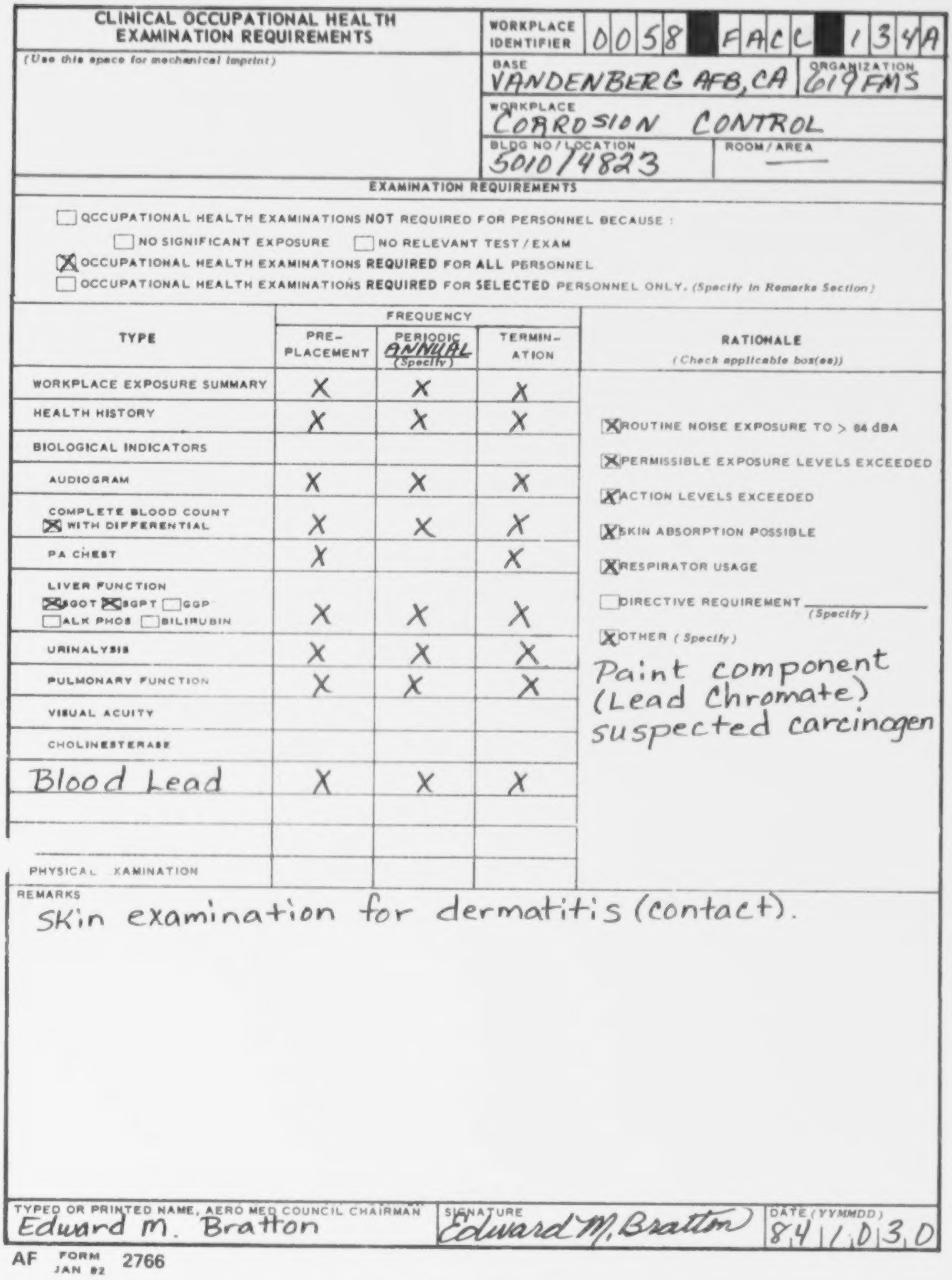
BLDG NO/LOCATION: 5010/4823

ROOM/AREA: —

DATE (YYMMDD)	NAME (Last, First, MI)	SSAN	RECORD ACTION					COMMENTS
			RESPIRATOR		HAZ. NOISE		OTHER	
			TRAIN	FIT TEST	TRAIN	FIT TEST		
841103	Dennis Cooper Cooper, Dennis C	123-45-6781			X	X		V-51R Large, both ears
841104	Karla Sansom Sansom, Karla M	478-33-7797			X	X		V-51R X-small - Rt. ear small - Lt. ear
841104	Mary E Hatfield Hatfield, Mary E	849-80-0747	X	X				MSA - Comfo II, TC-23C-118, OK (MED) Scott - Half face, TC-23C-80 - LEAKAGE
841104	Brian T. Hayden Hayden, Brian T	124-79-2011	X	X				Scott - Half face, TC-23C-80 - OK (SM) MSA - Comfo II, TC-23C-118 - LEAKAGE
841104	Jakarta E. Washington Washington, Jakarta E	110-06-1972	X	X				MSA - Comfo II, TC-23C-118, OK
841104	Raymond R Price Price, Raymond R	123-46-9476	X	X				Claustrophobic Reaction MED. EVAL. Recommended
841104	Lela L Potter Potter, Lela L	465-78-4321	X	X				MSA - Comfo II, TC-23C-118, OK
841104	Dick R Monod Monod, Dick R	534-23-4568	X	X				MSA - Comfo II, TC-23C-118, OK

AF FORM JAN 82 2767

Figure 2-6. Sample, AF Form 2767.



CLINICAL OCCUPATIONAL HEALTH EXAMINATION REQUIREMENTS

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WORKPLACE IDENTIFIER: 0058 FACC 134A

BASE: VANDENBERG AFB, CA

ORGANIZATION: 619 FMS

WORKPLACE: CORROSION CONTROL

BLDG NO/LOCATION: 5010/4823

ROOM/AREA: —

EXAMINATION REQUIREMENTS

☐ OCCUPATIONAL HEALTH EXAMINATIONS **NOT** REQUIRED FOR PERSONNEL BECAUSE :

☐ NO SIGNIFICANT EXPOSURE ☐ NO RELEVANT TEST / EXAM

☒ OCCUPATIONAL HEALTH EXAMINATIONS **REQUIRED** FOR **ALL** PERSONNEL

☐ OCCUPATIONAL HEALTH EXAMINATIONS **REQUIRED** FOR **SELECTED** PERSONNEL ONLY. *(Specify in Remarks Section)*

TYPE	FREQUENCY		
	PRE-PLACEMENT	PERIODIC ANNUAL *(Specify)*	TERMINATION
WORKPLACE EXPOSURE SUMMARY	X	X	X
HEALTH HISTORY	X	X	X
BIOLOGICAL INDICATORS			
AUDIOGRAM	X	X	X
COMPLETE BLOOD COUNT ☒ WITH DIFFERENTIAL	X	X	X
PA CHEST	X		X
LIVER FUNCTION ☒ SGOT ☒ SGPT ☐ GGP ☐ ALK PHOS ☐ BILIRUBIN	X	X	X
URINALYSIS	X	X	X
PULMONARY FUNCTION	X	X	X
VISUAL ACUITY			
CHOLINESTERASE			
Blood Lead	X	X	X
PHYSICAL EXAMINATION			

RATIONALE
(Check applicable box(es))

☒ ROUTINE NOISE EXPOSURE TO > 84 dBA

☒ PERMISSIBLE EXPOSURE LEVELS EXCEEDED

☒ ACTION LEVELS EXCEEDED

☒ SKIN ABSORPTION POSSIBLE

☒ RESPIRATOR USAGE

☐ DIRECTIVE REQUIREMENT ________ *(Specify)*

☒ OTHER *(Specify)*

Paint component (Lead Chromate) suspected carcinogen

REMARKS

Skin examination for dermatitis (contact).

TYPED OR PRINTED NAME, AERO MED COUNCIL CHAIRMAN: Edward M. Bratton

SIGNATURE: Edward M. Bratton

DATE (YYMMDD): 841030

AF FORM JAN 82 2766

Figure 2-7. Sample, AF Form 2766.

OCCUPATIONAL STRUCTURE CODES (OSC)	DESIGNATED INDUSTRIAL AREAS
2R3100	METAL PROCESSING
2R3200	STRUCTURAL REPAIR
2R3300	SURVIVAL EQUIP
2R3400	MACHINE SHOP
2R3500	PNEUDRAULICS
2R3600	ENVIRONMENTAL SYS
2R3700	NON DESTRUCT INSP
2R4000	INTEG AVIONICS
2R4100	AUTO TEST STATION
2R4200	MANUAL TEST STAINS

Figure 2-8. Functional account (FAC) and organizational structure (OSC) codes. These codes are different at every base.

Special purpose/periodic. These are specific tests and examinations done at intervals to evaluate and document the health effects of occupational exposures. The frequency, specific tests, and scope of these examinations are determined by the Aerospace Medicine Council, after considering all relevant exposure factors and regulatory guidances.

Termination. These are specific tests and examinations to determine pertinent aspects of the worker's health upon termination of employment. This examination may be beneficial in assessing the relationship of any future medical problems to work or exposures in the workplace.

Examination procedures. For us to describe to you what the procedures of an occupational physical are, we must take a good look at both the scheduling and processing of the examination.

Scheduling of occupational health examinations should be done in a timely and routine manner. This is the most important phase of your program. We must keep in mind that this task will involve coordination between the EHS, BES, and PES. A suggested format would be to schedule all occupational physicals by shop, 4 months after the BES periodic industrial hygiene survey. In doing so, trend analysis and occupational examination requirements can be determined prior to personnel receiving a physical for that year. This can easily be arranged by first obtaining a list of potential hazard areas and corresponding periodic survey schedules from BES. You must then confer with PES personnel to determine the maximum workload, by month, for these physicals. Now you are ready to design computer products suitable to your local needs. You will need separate computer rosters for military and DAF civilian personnel.

Scheduling. You should identify directly to the consolidated base personnel office (CBPO) and the central civilian personnel office (CCPO) those designated potentially hazard exposure areas where workers are required to receive an examination. These results should be identified by their functional account (FAC) or organizational structure code (OSC) (fig. 2-8). If, by nature of the exposure, only selected individuals within an area require examination, additional identifying features such as Air Force specialty codes should be used.

As the names of newly assigned workers are sent to you by the CBPO and CCPO, you should screen their medical records and schedule appointments as needed. In addition, CBPO and CCPO will generate, at your request, an occupational verification roster. You and the shop supervisors can use this roster to ensure that workers receive timely occupational health examinations.

Basic health examinations required by Air Force publications are listed in AFOSH Standard 161-17. However, this list is not all encompassing. Additional studies and/or frequency of examination can be added by the Aerospace Medical Council based on type of exposure and work environment.

All personnel who are to receive an occupational physical must have an occupational health code. There is preliminary work that must be done before you can code these physicals accurately. The BES must determine the occupational exposure for each shop and the Aeromedical Council must decide specifically what exams are to be done for each shop. Then you need to compile this information into a usable format that can be adapted into a computer system. We will discuss a suggested format for doing this task.

You have to determine the best way to identify shops and personnel from information available in the CBPO/CCPO computer. A combination of FAC/OSC and AFSC is a system that works well for about 90 percent of the shops. The most difficult—but most important—aspect at this point is to find out exactly which FAC/OSC is being used for each shop (fig. 2-8). A couple of things will help you do this. First, you can request a printout of the local FAC's and OSC's and their corresponding shops from CBPO.

Request the list only on the shops designated as potential hazard areas by the BES. This roster will serve as a master list to be used with other rosters for the Occupational Health Program. You may find a few shops listed under the same FAC/OSC, which is no problem if they all have the same occupational examination requirements. If they don't, however, you need to investigate. Do personnel rotate jobs frequently enough to warrant using the same occupational code for everyone, or do you need to individually code only those people actually in the shop? You must contact the shop supervisors to obtain this information. If personnel need be coded individually then you must verify this with the shop supervisor.

a. Master Computer Roster. Obtain a master computer roster to "clean up" the present codes and dates of last exam. CBPO personnel System management and CCPO personnel should be able to help you get what you need from the computer.

You can request a one-time master roster with corresponding re-entry cards. You want the potentially hazardous areas identified by the BES, broken down by squadrons first and then by the selected FAC or OSC (whichever suits your needs the best). For each person on the roster, you need the following information: name, rank, SSAN, FAC/OSC, AFSC, date of birth (DOB), date of assignment (DAS), or date eligible for return from overseas (DEROS) and all clinical examination codes and dates of the last examination presently in the computer system. The cards should correspond with the roster and should have the name, SSAN, and squadron printed on the top of each card. You will compare this roster to your master FAC/OSC listing for identification of each shop title. This will be a mountain of papers and cards, but well worth the effort it will take.

With the master personnel rosters and accurate clinical exam listing on hand, all you need to do now is compare the two. Code personnel within each shop using the occupational health examination codes listed in table 2-1 and entering a date to tell the computer when to print the name for the next exam. The next exam date is always 1 year from the date in the computer, with a few exceptions; i.e., local conditions requiring personnel to receive more frequent exams. If the design of the scheduling products is to be after the BES periodic survey, code the date of last exams to ensure all of the shop personnel receive a physical within a 2-month period. This can easily be done by coding half the personnel for 1 month. You will annotate the codes on the roster by lining through the present exam codes and date of last exam and writing "ADD" and the desired codes (table 2-1). You must also annotate the computer re-entry cards using the same codes.

This must be done for all personnel within each shop; then the first copy and re-entry cards should be hand-carried to CBPO and CCPO. This updated version of the master personnel roster will be the data base for the occupational verification roster which will ideally be recurring on an annual basis.

b. Occupational Verification Roster. This computer roster can be requested as often as required from CBPO and CCPO, as already mentioned, but you will need to receive it at least on an annual basis. You will use this roster at least annually to verify the occupational health examination codes, dates of last exam, and the occupational status of industrial workers. The original will be maintained in Tab F of the case file and the second copy in the EHS, which will be updated as necessary, then forwarded to CBPO and CCPO for an updated printout in the month corresponding to the periodic industrial hygiene (IH) survey. If for some reason (i.e., PCS/PCA or separation), an individual must be deleted from this roster, you will line through the entire line on that person, write DELETE and the reason why - PCS. If an individual is to be added, simply write in all identifying information, ensuring the date of exam code corresponds to the month the individual should receive a physical. This updated information must be annotated on the EHS file copy, because the original must never be removed from the case file.

c. Monthly Newcomer's Roster. The monthly newcomer's roster will guide you in scheduling base line physicals and help you to keep the system accurate. The format should be the same as your occupational verification roster, with personnel listed in alphabetical order by squadrons instead of shops. Request the personnel listing for only those assigned to a potential hazard area. The roster should print out about mid-month, listing arrivals from the previous month.

EHS must review the health records of all incoming personnel in potential hazard areas and annotate the SF 600 appropriately. If a base line physical is required write "*Base line*" and the appropriate exam codes next to the individual's name on the roster. If the person has received an occupational physical within the past 6 months, code the date of last exam to correspond with the month that individual will receive a physical, according to the shop's routine schedule. Simply enter the exam codes for those requiring periodic physicals.

Annotate identifying information for each individual on the appropriate occupational verification roster maintained in EHS; then forward the roster to PES. Once PES performs the physicals, the roster will be returned to EHS to be screened for "*no show*" rates. Return the completed roster to CBPO/CCPO for computer entry and maintain the second copy in EHS file for future reference.

d. Monthly Occupational Examination Roster. This roster will list all individuals requiring a physical in a particular month. The format is the same as the occupational verification roster, but instead of listing the

TABLE 2-1

OCCUPATIONAL HEALTH EXAMINATION CODES

DATA CODES	*DESCRIPTION (see note 1)*
A (see notes 3 and 4)	Exposure to other than noise. Requires examination at least annually and upon separation or retirement.
B (see note 2)	Exposure to noise. Requires baseline (reference) examination upon arrival at first permanent duty station.
L (see notes 3, 4, and 5)	Requires examination upon PCS/PCA and upon separation or retirement.
M (see note 3)	Exposure to noise. Requires examination at least annually and upon separation or retirement.
R (see notes 4 and 5)	Requires examination upon PCS/PCA.
S (see note 4)	Exposure to other than noise. Requires examination at least annually.

NOTES: 1. If none of the above codes apply, leave blank.

2. This code is not input by the CBPO. It is input through the PACE System for personnel classified into certain AFSCs listed in AFR 161-35 and the code flows to the member's first permanent duty station. After the member receives the base line (reference) examination and upon separation or retirement.

3. When an individual is identified with codes A, L, and M, DIN IAD (TERM-PHYREQ) will automatically be set to "1" and remain until the member is separated or retired, at which time member must have a termination examination according to AFR 161-33.

4. Code A or S may be input, but not both simultaneously, or code L or R, but not both simultaneously. There is no precedence associated with either series; that is, S can replace A or vice versa, and L can replace R or vice versa.

5. Codes L and R will generate notices for the required examination 60 days prior to projected departure date.

date of last examination, there should be a blank for entry of the current examination date. You must compare this roster to the occupational verification roster to ensure that all personnel you coded to receive a physical for that month are on the roster. This roster will also list (out of sequence) individuals requiring termination examinations (PCA/PCS or separation). Forward the roster to PES for scheduling. PES personnel must contact the unit's medical monitor and set appointments for all individuals requiring a physical. At the end of the month, PES will return the roster to EHS for calculation of "no show" rates. Clearly identify (in pencil) all no shows and the month and reason for missing the appointment on the occupational verification roster. Any individual who no longer requires a physical that month must be clearly identified. For example, if a worker has gone PCS to another base, PES will line through the data and write DELETE - PCS in bold letters. Identify that individual on the file occupational verification roster, using the same procedure. Immediately forward the monthly roster to CBPO/CCPO. All no shows will appear on the next monthly roster.

Additionally, there are other uses for these computer products. You can use the occupational verification roster to verify attendance at health education classes. The newcomer's roster can be used to ensure attendance at initial briefings required for incoming personnel. You can also use the same format as this roster to develop a roster for the hospital employee health program. Computer products are essential in scheduling all phases of the occupational health program. When they are designed in a simple and exact format to fit the needs at your base, they will become a handy tool for ensuring that your program runs smoothly.

Processing. As previously mentioned, the AF Form 2755, Master Workplace Summary, serves as Part 1 of the occupational health examination. It gives the health care provider a picture of the worker's occupational exposure environment.

The second part of the examination, AF Form 2768, Supplemental History, is completed by the workers receiving a baseline examination which further develops the workers' occupational exposure picture. If on subsequent examinations the responses remain unchanged, workers verify the information by initialing in the appropriate box. This form is then screened by the physical examination and standards section (PES) personnel who ensure all positive answers are fully explained.

SF 88, Report of Medical Examination, and AF Form 2769, Supplemental Data Sheet (fig. 2-9), are used as appropriate. Since most workers receive screening biological indicator tests as opposed to a "laying on of the hands" type examination, the AF Form 2769 is used to record the results of these tests. Other studies such as audiometric, electrocardiogram, and tuberculin skin test results are recorded on those designated forms specified by other regulations.

Upon completion of the worker's examination, a written medical opinion of the results of the worker's occupational health examination is recorded on the AF Form 2770, Assessment and Disposition (fig. 2-10). The original is maintained in the individual worker's medical record, while the second copy is forwarded by PES to EHS so that appropriate followup and evaluations can be done; remaining copies are distributed as specified on the form.

Exercises (211):

1. What is a preplacement or baseline occupational examination?

2. Why are special-purpose or periodic examinations accomplished?

3. How can you identify to CBPO/CCPO designated potentially hazardous work areas where workers are required to receive an examination?

4. Who determines the types of tests required for a specific type of occupational examination?

5. For shops that have the same FAC/OSC, how do you determine the occupational examination requirements when the workers don't all do the same job?

6. What type of information will you need for each individual on the master computer roster?

7. What is used as the "data base" for the occupational verification roster?

8. Where should the original copy of the occupational verification roster be maintained?

9. Describe how to delete someone from the occupational verification roster.

10. How do you use the monthly newcomer's roster?

11. What is the difference in the occupational verification roster and the monthly occupational exam roster?

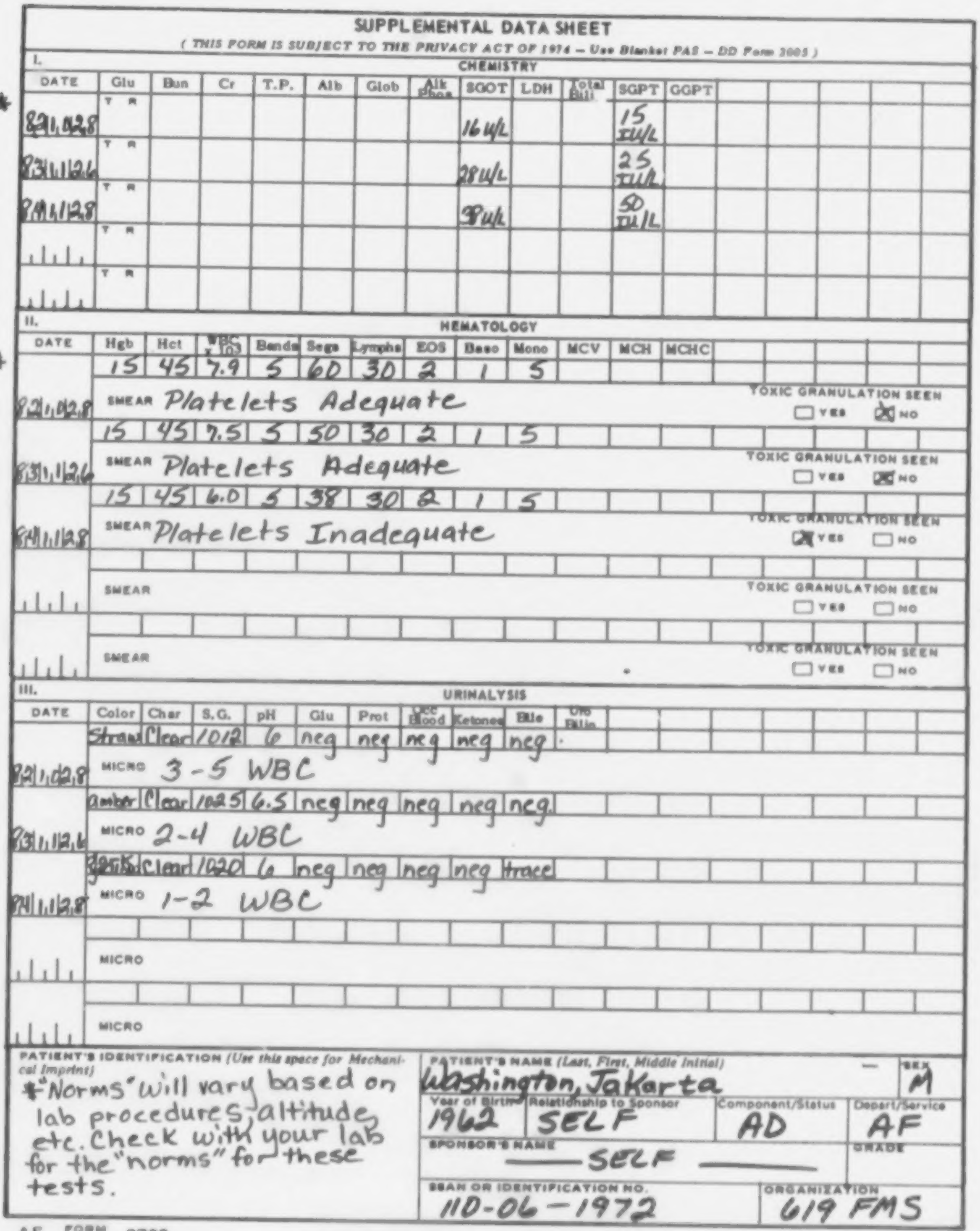
12. State some other uses for these computer products.

2-3. Evaluation of Trends in the Workplace/Worker

An evaluation of the trends in the workplace/worker may also be referred to as "an epidemiological summary." Remember, in Volume 1 we talked a great deal about the chain of infection: source, mode of transmission, and susceptible individual. This same "chain" applies to occupational medicine. For example, the source may be degreasing solvent; the mode of transmission, skin contact; and the susceptible individual, the individual worker. The whole purpose of evaluation of trends in the worker or workplace is to break this chain, thereby protecting worker health. In the comprehensive occupational health program, we do this evaluation for two basic reasons: to identify any adverse trends in health in the workplace possibly caused by an occupational exposure and to verify the occupational status of the worker.

212. State how to evaluate adverse health trends in the workplace and how to verify the occupational status of the worker.

Evaluation of Health Trends. This is done by reviewing—by shop—complete health records of the workers, paying close scrutiny of histories for common symptoms, biological screening test results, and reasons for



SUPPLEMENTAL DATA SHEET

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 – Use Blanket PAS – DD Form 2005)

I. CHEMISTRY

DATE	Glu	Bun	Cr	T.P.	Alb	Glob	Alk Phos	SGOT	LDH	Total Bili	SGPT	GGPT					
* 821028	T R							16 u/L			15 IU/L						
831126	T R							28 u/L			25 IU/L						
841128	T R							38 u/L			50 IU/L						
	T R																
	T R																

II. HEMATOLOGY

DATE	Hgb	Hct	WBC x 10³	Bands	Segs	Lymphs	EOS	Baso	Mono	MCV	MCH	MCHC					
* 821028	15	45	7.9	5	60	30	2	1	5								
	SMEAR Platelets Adequate													TOXIC GRANULATION SEEN ☐ YES ☒ NO			
831126	15	45	7.5	5	50	30	2	1	5								
	SMEAR Platelets Adequate													TOXIC GRANULATION SEEN ☐ YES ☒ NO			
841128	15	45	6.0	5	38	30	2	1	5								
	SMEAR Platelets Inadequate													TOXIC GRANULATION SEEN ☒ YES ☐ NO			
	SMEAR													TOXIC GRANULATION SEEN ☐ YES ☐ NO			
	SMEAR													TOXIC GRANULATION SEEN ☐ YES ☐ NO			

III. URINALYSIS

DATE	Color	Char	S.G.	pH	Glu	Prot	Occ Blood	Ketones	Bile	Uro Bilin							
* 821028	Straw	Clear	1012	6	neg	neg	neg	neg	neg								
	MICRO 3-5 WBC																
831126	amber	Clear	1025	6.5	neg	neg	neg	neg	neg.								
	MICRO 2-4 WBC																
841128	[illegible]	Clear	1020	6	neg	neg	neg	neg	trace								
	MICRO 1-2 WBC																
	MICRO																
	MICRO																

PATIENT'S IDENTIFICATION *(Use this space for Mechanical Imprint)*

* "Norms" will vary based on lab procedures, altitude, etc. Check with your lab for the "norms" for these tests.

PATIENT'S NAME *(Last, First, Middle Initial)*: Washington, Jakarta —

SEX: M

Year of Birth: 1962

Relationship to Sponsor: SELF

Component/Status: AD

Depart/Service: AF

SPONSOR'S NAME: —— SELF ——

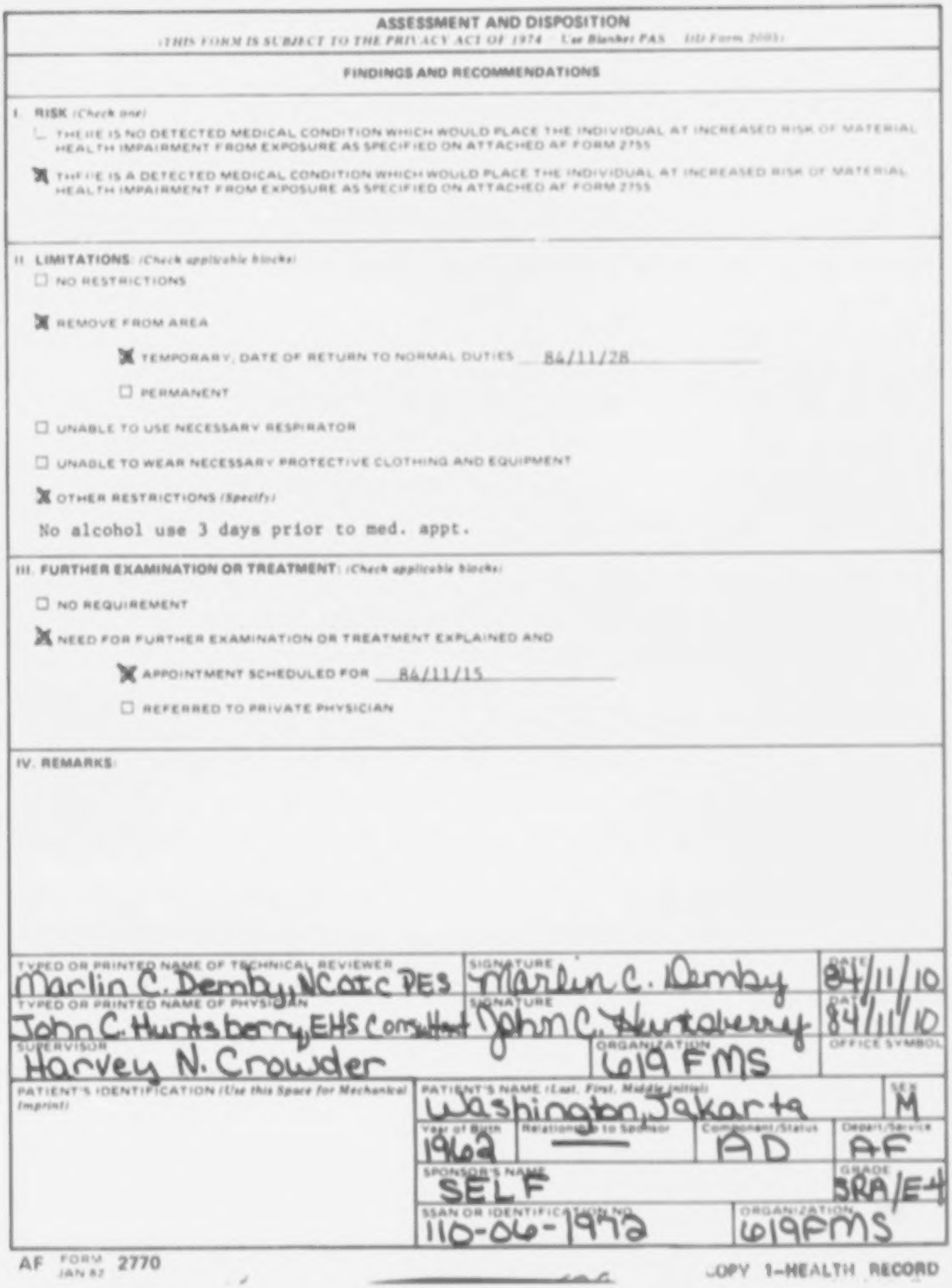
GRADE:

SSAN OR IDENTIFICATION NO.: 110-06-1972

ORGANIZATION: 619 FMS

AF FORM JAN 82 2769

Figure 2-9. Sample, AF Form 2769.



ASSESSMENT AND DISPOSITION

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 — Use Blanket PAS — DD Form 2005)

FINDINGS AND RECOMMENDATIONS

I. **RISK** *(Check one)*

☐ THERE IS NO DETECTED MEDICAL CONDITION WHICH WOULD PLACE THE INDIVIDUAL AT INCREASED RISK OF MATERIAL HEALTH IMPAIRMENT FROM EXPOSURE AS SPECIFIED ON ATTACHED AF FORM 2755

☒ THERE IS A DETECTED MEDICAL CONDITION WHICH WOULD PLACE THE INDIVIDUAL AT INCREASED RISK OF MATERIAL HEALTH IMPAIRMENT FROM EXPOSURE AS SPECIFIED ON ATTACHED AF FORM 2755

II. **LIMITATIONS:** *(Check applicable blocks)*

☐ NO RESTRICTIONS

☒ REMOVE FROM AREA

- ☒ TEMPORARY, DATE OF RETURN TO NORMAL DUTIES 84/11/28
- ☐ PERMANENT

☐ UNABLE TO USE NECESSARY RESPIRATOR

☐ UNABLE TO WEAR NECESSARY PROTECTIVE CLOTHING AND EQUIPMENT

☒ OTHER RESTRICTIONS *(Specify)*

No alcohol use 3 days prior to med. appt.

III. **FURTHER EXAMINATION OR TREATMENT:** *(Check applicable blocks)*

☐ NO REQUIREMENT

☒ NEED FOR FURTHER EXAMINATION OR TREATMENT EXPLAINED AND

- ☒ APPOINTMENT SCHEDULED FOR 84/11/15
- ☐ REFERRED TO PRIVATE PHYSICIAN

IV. **REMARKS:**

TYPED OR PRINTED NAME OF TECHNICAL REVIEWER: Marlin C. Demby, NCOIC PES
SIGNATURE: Marlin C. Demby
DATE: 84/11/10

TYPED OR PRINTED NAME OF PHYSICIAN: John C. Huntsberry, EHS Consultant
SIGNATURE: John C. Huntsberry
DATE: 84/11/10

SUPERVISOR: Harvey N. Crowder
ORGANIZATION: 619 FMS
OFFICE SYMBOL:

PATIENT'S IDENTIFICATION *(Use this Space for Mechanical Imprint)*

PATIENT'S NAME *(Last, First, Middle initial)*: Washington, Jakarta
SEX: M
Year of Birth: 1962
Relationship to Sponsor: —
Component/Status: AD
Depart/Service: AF
SPONSOR'S NAME: SELF
GRADE: SRA/E-4
SSAN OR IDENTIFICATION NO.: 110-06-1972
ORGANIZATION: 619FMS

AF FORM JAN 82 2770 — COPY 1—HEALTH RECORD

Figure 2-10. Sample, AF Form 2770

seeking medical treatment. At least annually, the EHO should document the results of this monitoring on AF Form 2754, Chronological Record of Workplace Surveillance. If adverse trends are noted during this annual review, you should notify the BES so that they can investigate work practices and/or other causes.

Verification of Occupational Status. You should verify, at least annually, the occupational health examination information codes and date of last examination and occupational status of industrial workers. This verification is done by using the occupational verification roster, as discussed earler.

This chapter has looked at the way we do business in the 80s—a way that will: ensure the quality and the comprehensiveness of the data related to the worker and the workplace; formally link health data with exposure data; and allow for a natural and efficient progression to computerization. That way of doing business is the Comprehensive Occupational Health Surveillance Program.

Exercises (212):

1. How often, and on which form, should you document the results of your evaluations of the workplace?

2. If you detect adverse trends in your evaluation, what should you do?

3. When you verify the occupational status of the worker, what specifically are you verifying?

4. How often should the verification of occupational status be done?

CHAPTER 3

Respiratory Protection Program

THE National Institute of Occupational Safety and Health (NIOSH) has recently developed a suggested list of the 10 work-related diseases or injuries. Three criteria were used to develop the list: the disease or injury's frequency of occurrence, its severity in the individual case, and its amenability to prevention. The top ranked problem on the list is occupational lung diseases. As an environmental medicine specialist, you play a major role in providing a safe and healthful environment to Air Force industrial workers. The recognition of occupational lung diseases or other disorders caused by the inhalation of toxic substances may be difficult. The latent period may be as long as 15 years as for silicosis or 30 or more years as for asbestos-related diseases. Occupational lung diseases are preventable. Although years of effective control measures will be required to eliminate diseases of long latency, we do have a tool we can work with. Our tool is respiratory protection. An effective respiratory protection program is the ideal measure for protecting Air Force workers when unsafe atmospheric conditions cannot be otherwise eliminated.

3-1. Types of Respirators

In the control of those occupational illnesses caused by breathing air contaminated with harmful particulates, vapors, or gases, the primary objective is to prevent exposure to contaminated atmospheres. This should be accomplished as far as feasible by accepted control measures (for example, enclosure or confinement of the operation and general and local ventilation). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators must be used.

The purpose of any respirator is very simply: to protect the respiratory system from harmful airborne physical or chemical agents. It provides this protection by removing or chemically changing the airborne contaminant before it is inhaled (air purifying) or by supplying an independent source of respirable air (atmosphere supplying).

213. Specify the major classifications of respirators, their uses, limitations, and proper maintenance.

Respiratory Inlet Coverings. The respiratory inlet covering serves as an impervious barrier against the contaminated atmosphere and as framework to which air purifying or atmosphere supplying elements may be attached.

Tight fitting coverings are called facepieces and are made of flexible, molded rubber or plastic. There are three basic configurations. The first, called a quarter-mask, covers the mouth and nose only. Good protection may be obtained from the quarter-mask, but it is more easily dislodged than other types. A second type, the half-mask, fits over the nose and under the chin (fig. 3-1). Half-masks generally seal more reliably than quarter-masks, so they are preferred for use against more toxic materials. A third type is the full facepiece which covers from roughly the hairline to below the chin. (fig. 3-2). It provides the greatest protection and usually seals most reliably. Because the lenses or eyepieces must meet Federal impact and penetration specifications, full facepiece respirators provide eye protection as well. Full facepiece respirators, both air-purifying and atmosphere-supplying, are designed for use in higher concentrations of toxic materials than are quarter- or half-mask respirators. They may be used in less toxic atmospheres, but since they are expensive and difficult to maintain, little is gained by so using them unless eye protection is required. A special tight-fitting respirator that is coming into increasingly extensive use is the "single-use" disposable type. It is shaped much like the half- or quarter-mask, but the air purifier is permanently attached to the facepiece or the entire facepiece is made of filter material.

Loose-fitting coverings include hoods, helmets, blouses, and full body suits. The wide variety of designs precludes any simple description, but figure 3-3 shows a blouse that illustrates the principles of construction and operation of all such devices. Generally, loose-fitting respirators enclose at least the head, neck, and shoulders. This enclosure usually contains perforated rigid or flexible tubing through which clean compressed air is distributed around the breathing zone. A light flexible device covering only the head, neck, and shoulders is called a hood. If rigid protective headgear is incorporated into the design, it is called a helmet (fig. 3-4). Blouses extend to the waist, and some have wrist-length sleeves. Full body suits, as the name implies, enclose the whole body and allow additional air to be supplied to the extremities for cooling. Generally, full body suits are used where skin protection or temperature control, as well as respiratory protection, is required.

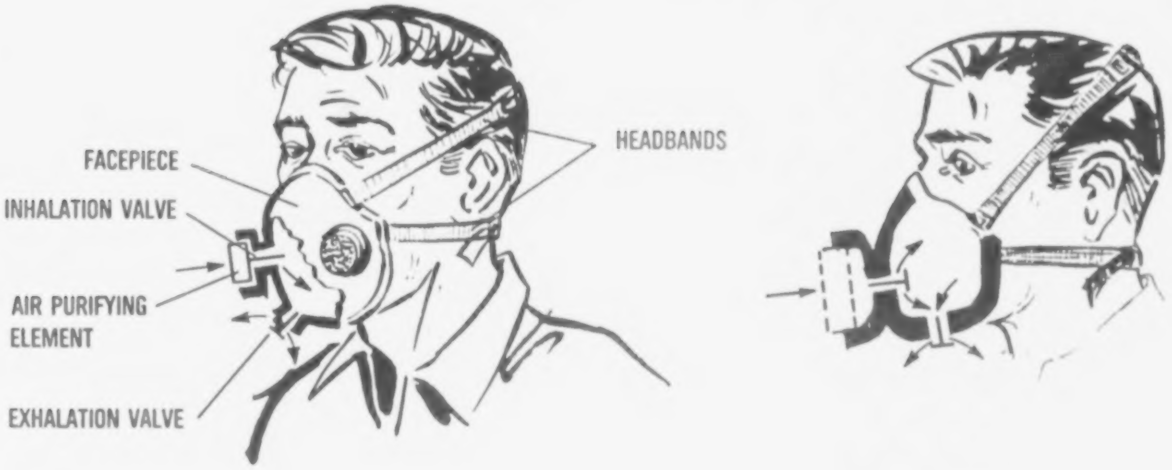


Figure 3-1. Half-mask respirator

Respirator Selection. There are three basic types of personal protective equipment available for the protection of the worker from respirable hazards: These are:

a. Air purifying respirators—canister type, cartridge type, and mechanical filter.

b. Air supplied respirators—hose-mask type, air-line and abrasive-blasting type.

c. Self-contained breathing-type respirators—recirculating and open circulating.

Before discussing each of these respirators in detail, let's look at the major criteria that should be considered when selecting the appropriate type of respirator.

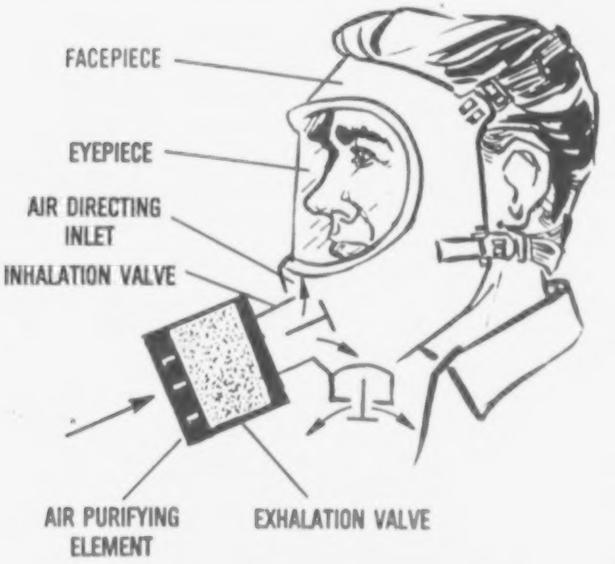


Figure 3-2. Full-face respirator

The proper respirator must be used for a given situation; otherwise, the respirator may provide a false sense of security and result in potential harm to the worker. The respirator used should be selected for the specific application involved.

There are many factors to consider in the selection of a respirator. The first thing to consider is the hazardous material that is involved. What is its chemical makeup and form? What are its characteristics? What are its chemical properties? What is the human physiological reaction to the material? What concentration of the material is present in the workplace?

Secondly, the conditions under which the worker will become exposed must be considered. Will the worker be required to perform normal work functions during exposure? This is likely to result when personal protective equipment is the final resort of protection that is available. Or, is the respirator to be used only for emergency conditions; that is, when a failure of the existing control system occurs?

Closely related to the conditions in which the respirator will be used is the time or duration of the exposure. Will the respirator be required for quick escape as is the case in emergency use, or will the respirator be required for a longer period of time to perform work duties in a hazardous environment?

If the respirator is to be used during the performance of regular duties, it is important to determine the type of activity that must be performed while using the respirator. Will the work require much physical effort? If so, will the respirator inhibit the employee's ability to perform work in any way?

Figure 3-5 illustrates how respirators are selected based on the type of hazard present in the work area. The actual selection of the type of respirator for the specific hazard is a responsibility of the BEE. This responsibility lies with them

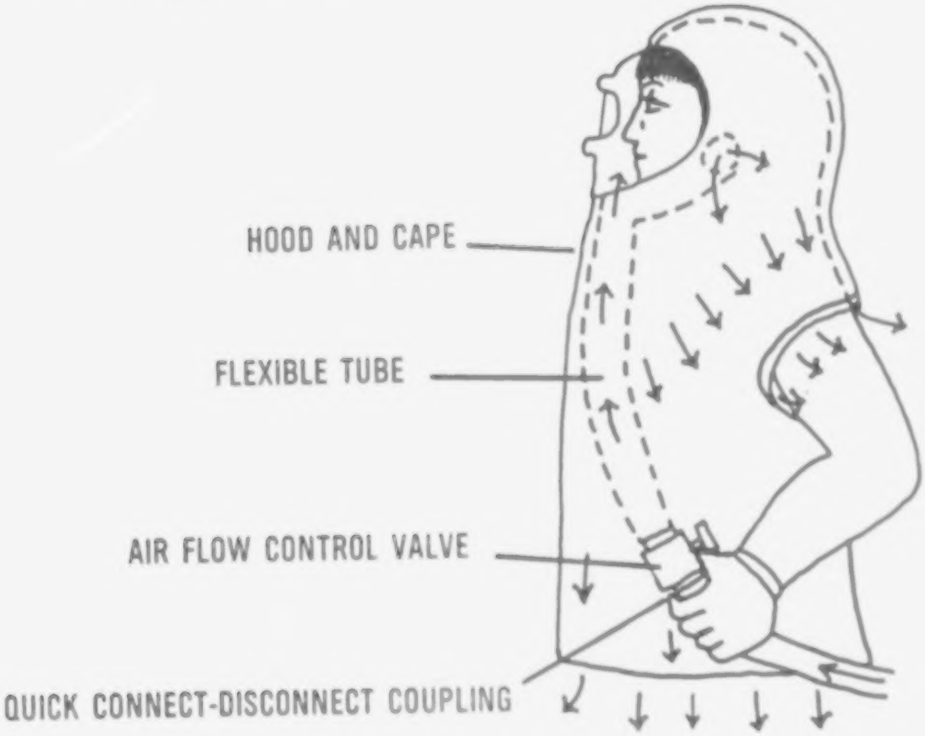


Figure 3-3. Respirator blouse

since they are most knowledgable of the hazards present in the workplace. Workers may ask you questions as to why they must wear one type instead of another, and you should be able to explain the basic rationale behind the selection of the respirator.

Another related question that must be asked but that does not directly involve the selection of the respirator is: What is the need for additional protection? While in the hazardous environment, will the employee be exposed in any way to the hazardous material? Is there a need for eye or skin protection? Does the hazardous material act as a systemic agent through the exposed skin of the employee? If so, protection must be provided for those exposed parts of the body.

When the term "respirable air" is used, it means that the supply of air (compressed gaseous air, compressed gaseous oxygen, liquid air, and liquid oxygen) that is used for respiration is of high purity. If it is compressed gaseous or liquid oxygen, it must meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen, and if chemically generated oxygen, it must meet the requirements of the U.S. Department of Defense Military Specification MIL–E–83252 or Military Specification MIL–O–15633c. TO 42B–1–22, *Quality Control of Compressed and Liquid Breathing Air*, specifies the periodic testing procedures to ensure quality breathing air. Compressed gaseous air must meet at least the requirements of the specification for Type I - Grade D breathing air, and liquid air must meet at least the requirements for Type II - Grade B breathing air as described in American National Standard Commodity Specification for Air, ANSI Z86.1–1973 (Compressed Gas Association Commodity Specification for Air).

Compressed gaseous air may contain low concentrations of oil. If high-pressure oxygen passes through an oil- or grease-coated orifice, an explosion or fire may occur. Therefore, compressed gaseous oxygen should not be used in supplied-air respirators or in open-circuit-type self-contained breathing apparatus that have previously used compressed air. Breathing air may be supplied to respirators from cylinders or air compressors. These cylinders must be tested and maintained to prevent the contamination of the air. If a compressor is used, it should be constructed and situated so as to avoid entry of contaminated air into the air-supply system and should be equipped with a suitable in-line air-purifying sorbent bed and filter to further assure breathing air quality. If an oil-lubricated compressor is used, it should be equipped with a high-temperature alarm or a carbon-monoxide alarm, or both. Assuring that proper "respirable air" is used in these types of respirators is a responsibility of the BEE. Periodic testing of compressed air may be accomplished by the BEE or the shop where the air is used. The BEE will be checking industrial areas for these requirements during their industrial hygiene surveys.

Air purifying respirators. One type of respirator that can be used is the air-purifying respirator. The purpose of this respirator is to remove contaminants from the air that is being respired. Because air-purifying respirators don't provide individuals with new oxygen, sufficient oxygen must be present within the environment to support life. Air-purifying respirators come in three major types: the canister type, the cartridge type, and the mechanical filter type.

Canister-type respirators. The canister-type air-purifying respirator consists of a full or half facepiece, often with a hose connecting the mask to a canister. The canister is filled with a material that chemically reacts with or absorbs the particular known contaminant to render it harmless. The canister-type respirator is limited to certain concentrations of a given substance. These concentrations are stated by the manufacturer in any data sheets involving the respirator and also on the canister itself.

The canisters utilize various chemical sorbents for particular materials. For example, canisters exist for removal of acid gases, organic vapors, carbon monoxide, vinyl chloride, ammonia, hydrogen sulfide, and chlorine.

The life of a canister varies and is generally based on a standard atmosphere and work rate. Factors that affect the life of a canister are the breathing rate of the individual using the canister, the temperature and humidity of the atmosphere in which the canister is being used, and the concentration of the contaminant in the atmosphere.

Some canisters come in a window design. The window indicates usage of the canister's capability for purifying the air. The window has a reference half circle of a given color. As the canister is used, the other half circle changes color. When the two colors match, the canister has lost its effectiveness.

Other canisters are available with electrical blowers to force air into the facepiece. While this is effective, forcing air through the canister dramatically shortens its life.

The canister-type respirator is often used for escape from a severely contaminated environment. In the Air Force the rocket propellant gas mask is used for protection against hydrazines. After the canister has been used in an emergency situation, no matter how long the use has been, it should be discarded. A partially used canister can present a potential hazard to the worker unless discarded because there is a tendency to assume that the canister is fully operational, when in fact, it will provide appropriate protection for a shorter period of time.

Cartridge-type respirators. The cartridge-type respirator

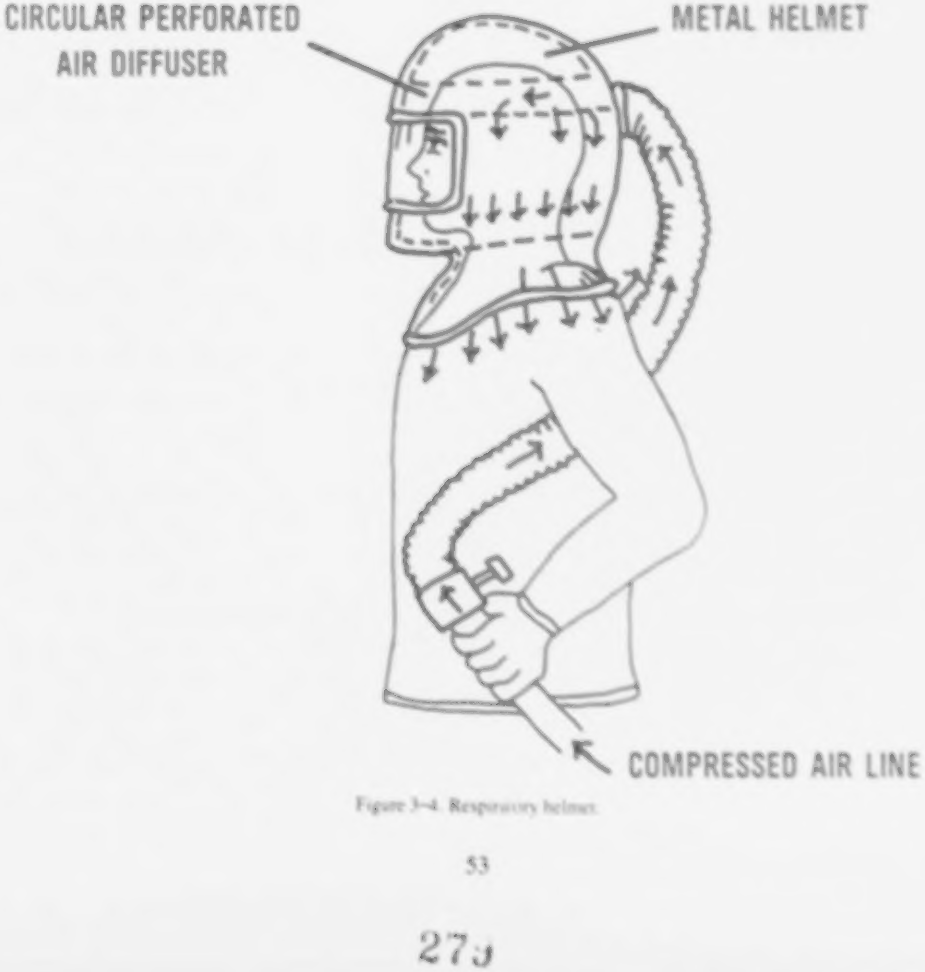


Figure 3-4. Respiratory helmet.

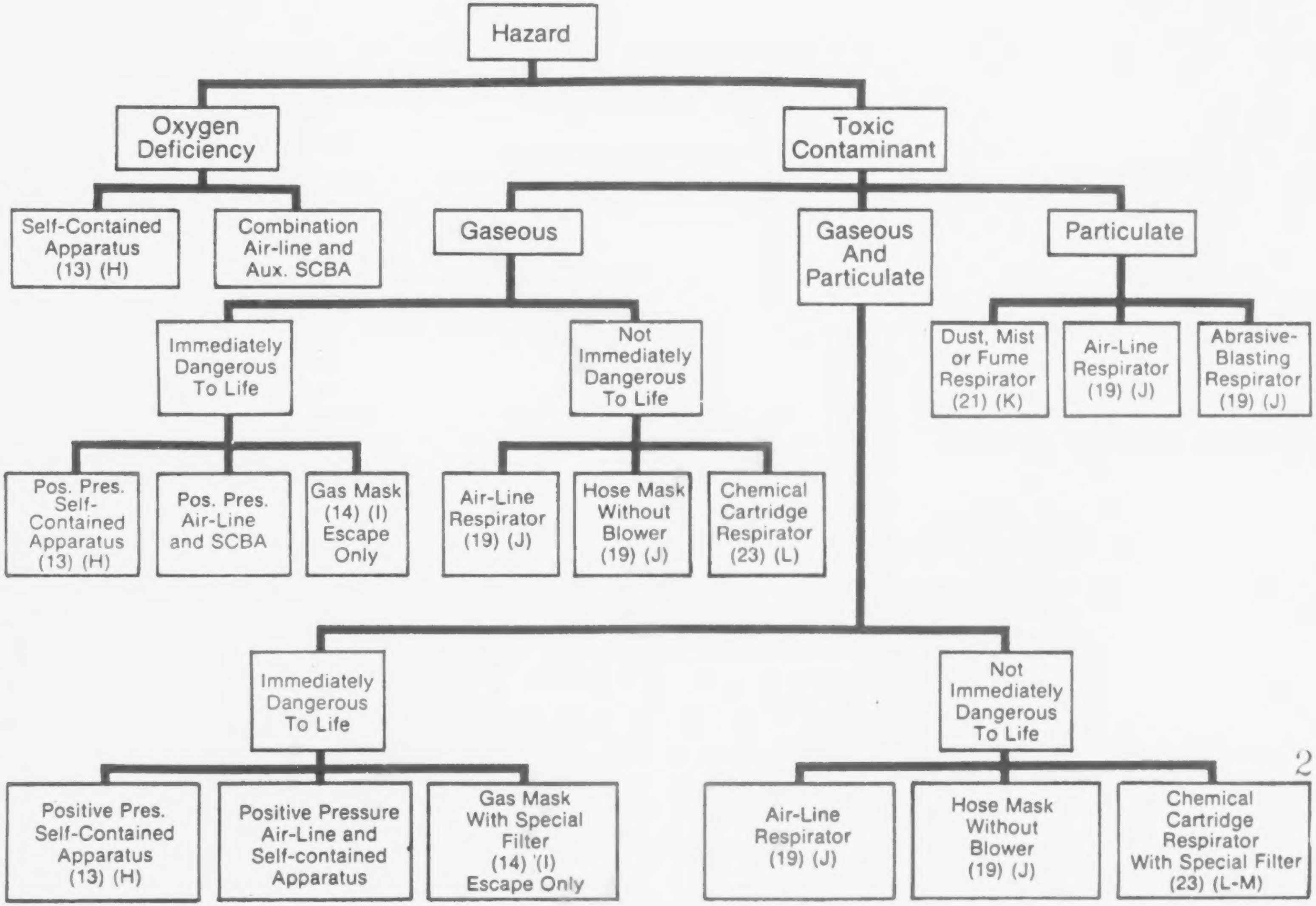

Hazard
Oxygen Deficiency
Toxic Contaminant
Self-Contained Apparatus (13) (H)
Combination Air-line and Aux. SCBA
Gaseous
Gaseous And Particulate
Particulate
Immediately Dangerous To Life
Not Immediately Dangerous To Life
Dust, Mist or Fume Respirator (21) (K)
Air-Line Respirator (19) (J)
Abrasive-Blasting Respirator (19) (J)
Pos. Pres. Self-Contained Apparatus (13) (H)
Pos. Pres. Air-Line and SCBA
Gas Mask (14) (I) Escape Only
Air-Line Respirator (19) (J)
Hose Mask Without Blower (19) (J)
Chemical Cartridge Respirator (23) (L)
Immediately Dangerous To Life
Not Immediately Dangerous To Life
Positive Pres. Self-Contained Apparatus (13) (H)
Positive Pressure Air-Line and Self-contained Apparatus
Gas Mask With Special Filter (14) (I) Escape Only
Air-Line Respirator (19) (J)
Hose Mask Without Blower (19) (J)
Chemical Cartridge Respirator With Special Filter (23) (L-M)

Figure 3–5. Outline for selecting respiratory protective devices.

is essentially a small canister called a cartridge (fig. 3-6) that is usually attached directly to the facepiece or mask. A half-mask with one or two cartridges is most common although a full- or quarter-mask may be used. Cartridge-type respirators work in a manner similar to the canister-type respirator. The major difference is the size of the smaller cartridge versus that of the canister.

Cartridges are approved for use in non-Immediately Dangerous to Life or Health (IDLH) situations only. Such situations involve an exposure to a material that is hazardous after a prolonged period of time or acutely irritating. Cartridge respirators are often used for protection against exposure to certain organic vapors, acid gases, particulates, and combined mist and fume. Additionally, these cartridges are color coded based on the protection afforded against a particular contaminant (fig. 3-7). Remember, all cartridges must also be certified by NIOSH for the protection provided and assigned a test control (TC) number (fig. 3-8). The cartridges must be changed when an odor is detected inside the mask, if air inside the mask feels hot, or as instructed in the shop standard operating procedures.

Mechanical filter-type respirators. The mechanical filter-type respirator involves a quarter-, half-, or full-mask with filters attached to the mask in the same manner as the cartridge-type respirator. The filters, which are composed of fibrous materials, are used to protect against dust, mist, and fumes and any combination thereof.

As with any filter, the efficiency is improved as it begins to clog or fill up. However, as the filter loads, the resistance to breathing increases and is a limiting factor for the use of the filter.

The filter medium that is used in a mechanical filter-type respirator varies. The type of filter used is rated, depending on its efficiency in removing various particle sizes from the atmosphere and breathing resistance. These ratings are available for each filter and should be considered prior to selection.

Air-supplied respirators. This type of respirator involves a mask to which a supply of air is provided. The air-supplied respirator comes in three general types: the hose mask, the air-line respirator, and the abrasive blasting-type respirator.

The hose mask involves a full or half facepiece with a one-inch-diameter collapsible hose attached. The hose is connected to a motor driven or hand-operated pump outside the contaminated atmosphere. The hose may also be connected to a positive air pressure source. The blower intake is located in an uncontaminated area and supplies air from that area to the worker through the hose.

This type of system should be of a fail-safe nature to allow for breathing in the event of a failure of the blower.

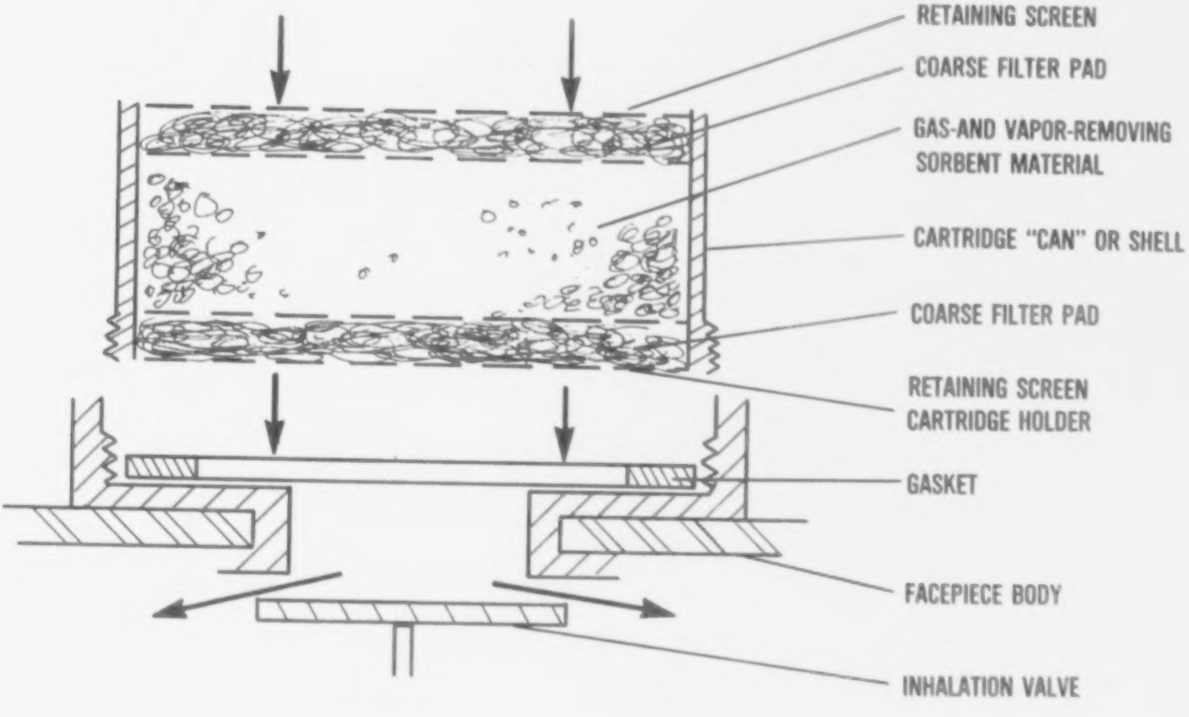


Figure 3-6. Internal composition of a cartridge.

Atmospheric Contaminants to be Protected Against	Color Assigned
Acid gases	White
Organic vapors	Black
Ammonia gas	Green
Carbon monoxide gas	Blue
Acid gases and organic vapors	Yellow
Acid gases, ammonia, and organic vapors	Brown
Acid gases, ammonia, carbon monoxide, and organic vapors	Red
Other vapors and gases not listed above	Olive
Radioactive materials (except tritium and noble gases)	Purple
Dusts, fumes, and mists (other than radioactive materials)	Orange

Notes:
(1) A purple stripe shall be used to identify radioactive materials in combination with any vapor or gas.
(2) An orange stripe shall be used to identify dusts, fumes, and mists in combination with any vapor or gas.
(3) Where labels only are colored to conform with this table, the canister or cartridge body shall be gray or a metal canister or cartridge body may be left in its natural metallic color.
(4) The user shall refer to the wording of the label to determine the type and degree of protection the canister or cartridge will afford.

Figure 3–7. Respirator cartridge color-code guide.

Very little resistance to breathing is encountered using the hose mask with a blower, and the worker can use it for a long period of time without fatigue. The length of the hose is limited to 300 feet.

The air-line respirator is essentially the same as the hose mask except it is connected to a compressor or compressed air cylinders. The connecting line is smaller in diameter and supplies air under pressure. The hose is attached to the wearer by a belt or other suitable means and can be detached rapidly in an emergency. A flow-control valve or orifice is provided to govern the rate of air flow to the wearer. Exhaled air passes to the ambient atmosphere through a valve(s) or opening(s) in the enclosure (facepiece, helmet, hood, or suit). Up to 300 feet of hose length is permissible. The air-line respirator comes in three classes:

a. Continuous-flow class is equipped with a facepiece, hood, helmet, or suit. At least 115 liters (4 cubic feet) of air per minute to tight-fitting facepieces and 170 liters (6 cubic feet) of air per minute to loose-fitting helmets, hoods, and suits are required. Air is supplied to a suit through a system of internal tubes to the head, trunk, and extremities through valves located in appropriate parts of the suit.

b. Demand type is equipped with a facepiece only. The demand valve permits flow of air only during inhalation.

c. Pressure-demand type is equipped with a facepiece only. This type produces a constant slight pressure of air with a demand valve to allow a greater flow of air on inhalation. A positive pressure is maintained in the facepiece.

The air-line respirator offers low-breathing resistance and is suitable for long wear in a contaminated atmosphere. A continuous flow or pressure-demand air-line respirator with an auxiliary self-contained supply of respirable air (escape bottle) may be used in an IDLH atmosphere.

The abrasive blasting-type respirator is composed of either a hose mask or an air-line respirator that is equipped with a helmet, hood, and inner collar that can be worn in an abrasive-blasting operation. The hood and helmet protect the worker's face and head from the impact of the abrasive material in the atmosphere.

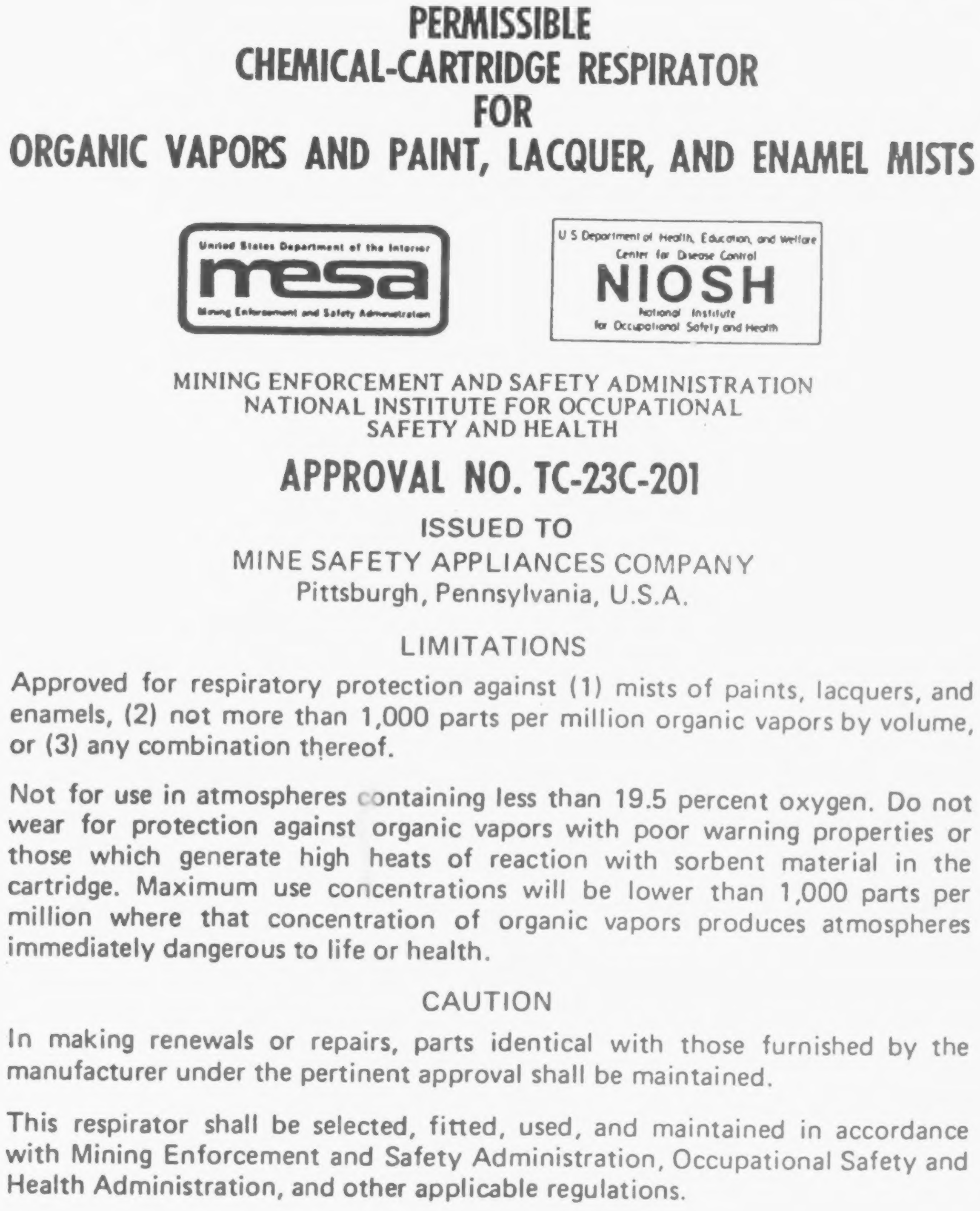
In an abrasive blasting-type respirator, the air enters the hood from the hose and is exhausted at the neck, collar, or through an exhalation valve.

An advantage of the air-supplied respirator is that it can be utilized in an area where the oxygen level is such that it cannot support life. For reasons of safety, such protection should be provided to the worker when the oxygen level is below 19.5 percent in the work area.

Self-contained breathing apparatus. As is the case with the air-supplied respirator, the self-contained breathing apparatus (SCBA) can be used in oxygen-deficient atmospheres. The self-contained breathing unit has the additional advantage of being usable in an area where distance or movement prohibits the use of a hose mask or an air-line respirator.

The SCBA is designed to allow the worker to carry a source of respirable air that is attached to the mask. The source of air may be supplied through oxygen-generating chemicals activated by moisture in the user's breath, liquid oxygen in a cylinder, or compressed air in a cylinder. Self-contained breathing units may be designed as either constant-flow type or demand-valve operated.

There are two types of SCBAs units being manufactured. The first is a recirculating or closed-circuit-type unit in which a reservoir bag is attached. This bag collects air exhaled from the worker. Oxygen is added to the exhaled air by passing the exhaled air through a canister in which carbon dioxide is retained and oxygen is evolved. The



PERMISSIBLE CHEMICAL-CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS AND PAINT, LACQUER, AND ENAMEL MISTS

United States Department of the Interior
mesa
Mining Enforcement and Safety Administration

U S Department of Health, Education, and Welfare
Center for Disease Control
NIOSH
National Institute for Occupational Safety and Health

MINING ENFORCEMENT AND SAFETY ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL
SAFETY AND HEALTH

APPROVAL NO. TC-23C-201

ISSUED TO
MINE SAFETY APPLIANCES COMPANY
Pittsburgh, Pennsylvania, U.S.A.

LIMITATIONS

Approved for respiratory protection against (1) mists of paints, lacquers, and enamels, (2) not more than 1,000 parts per million organic vapors by volume, or (3) any combination thereof.

Not for use in atmospheres containing less than 19.5 percent oxygen. Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge. Maximum use concentrations will be lower than 1,000 parts per million where that concentration of organic vapors produces atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

This respirator shall be selected, fitted, used, and maintained in accordance with Mining Enforcement and Safety Administration, Occupational Safety and Health Administration, and other applicable regulations.

Figure 3–8. Approval label for respirator cartridge.

oxygen may be added from compressed or liquid oxygen in a cylinder. This type of mask requires venting since an excess of oxygen is generally produced and must be vented.

The second type is the open-circuit type. This type of respirator involves supplying air to the worker directly from a cylinder. The exhaled air is vented to the atmosphere from the mask. Air time of the cylinder is generally 30 minutes, but may differ according to the workload and breathing rate of the user. The pressure-demand type open-circuit SCBA is most commonly used because it provides air at a positive pressure.

Exercises (213):

1. Identify true statements and explain why the others are false.
   ___ (1) Air-purifying respirators may be used in oxygen-deficient atmospheres.
   ___ (2) The window in the canister indicates the usage of the canister's capability for purifying air.
   ___ (3) Half-mask respirators provide the best protection against highly toxic airborne contaminants.
   ___ (4) As the filter of a mechanical filter-type respirator begins to clog or fill up, the efficiency is decreased.
   ___ (5) The blower intake on an air-supplied respirator should be as close as possible to the industrial process.
   ___ (6) An airline respirator can have a demand-type valve to regulate the flow of air to the worker.
   ___ (7) Two types of respirators that may be used in an oxygen-deficient atmosphere are the air-supplied and self-contained breathing units.

3-2. Training

The Environmental Health Service has the primary responsibility of fit testing and training personnel in the use of respirators. Such training should include why respirators are necessary and the necessity for proper handling of the equipment, proper fit, inspection, cleaning, and storage of the respirator. Where a respirator is used in an emergency condition, the workers should be familiar with emergency procedures and should drill using the procedures on a regular basis. Included in our training program is ensuring that personnel are physiologically and psychologically fit to wear respirators and certifying the workers for the use of the respiratory device(s) that are required when performing certain job tasks.

214. State the elements and responsibilities of each type of respiratory protection training.

Types of Training. There are three types of training: initial use, supervisory, and refresher. The extent and frequency of the worker's training depends primarily on the nature and extent of the hazard. Because proper respirator use depends especially upon the workers' motivation, it is important that the need for the respirator be stressed in any type of training provided.

Initial use training. You have the responsibility of conducting initial use training to workers prior to the worker performing job tasks that require the use of a respiratory device. This is a one time training requirement; however, once a year would be ideal if your workload allows—people change, get fatter, become thinner, wear dentures, etc. It need not be repeated when a worker changes jobs, unless a different type of respirator is being used, in which case the worker must be trained for its particular use. As a minimum, such training should include:

a. The reasons for the need of respiratory protection.

b. The nature, extent, and effects of respiratory hazards to which the person may be exposed.

c. An explanation of why engineering controls are not being applied or are not adequate and what effort is being made to reduce or eliminate the need for respirators.

d. An explanation of why a particular type of respirator has been selected for a specific respiratory hazard.

e. An explanation of the operation and the capabilities and limitations of the respirator selected.

f. Instructions in inspecting, donning, checking the fit of, and wearing the respirator.

g. An opportunity for each respirator wearer to handle the respirator, learn how to don and wear it properly, check its seals, wear it in a safe atmosphere, and wear it in a test atmosphere.

h. An explanation of correct maintenance and storage of the respirator.

i. Instructions in how to recognize and cope with emergency situations.

Supervisory training. Additionally, you must provide one-time training to the supervisors—those persons who have the responsibility of overseeing the work activities of one or more persons who must wear respirators. This training is most important to ensure the proper use of respirators in the workplace. Supervisor training should include but is not necessarily limited to the following subjects:

- The basic respiratory protection practices.
- The nature and extent of respiratory hazards to which persons under his or her supervision may be exposed.
- The principles and criteria of selecting respirators.
- The training of respirator wearers.
- The issuance of respirators.
- The inspection of respirators.
- The use of respirators, including monitoring of use.
- The maintenance and storage of respirators.
- The regulations concerning respirator use.
- Development of a written standard operating procedure to ensure the safe use of respirators.

The supervisor should also be given guidance in procuring the makes and models of the types of respirators. The worker's acceptance of a particular respirator model within a class should be considered in selecting a respirator since this may determine whether or not he or she wears the respirator properly. Acceptance factors to be considered include discomfort, breathing resistance, weight, and interference with vision or the work to be performed.

Each of these subjects should be discussed in detail so that the supervisor is familiar with the entire operation of the respiratory protection program. The supervisor is the link between the worker and the medical facility. Therefore, knowledge of the reasons this equipment is necessary and how it should be used is very important to the supervisor so that everyday monitoring and worker motivation will be enhanced. The Environmental Health Service will provide technical guidance and assistance to the supervisor in the development of "in-house programs" within the shops.

Refresher training. Refresher training is the responsibility of the unit commander. However, the Environmental Health Service should provide technical assistance to commanders in establishing any repetitive training programs required. Refresher training is scheduled as necessary except for workers who use respirators for emergency escape or rescue; these workers must receive refresher training annually. This training, as a minimum, should include recognition of the end of service life, care, maintenance, and storage of the emergency-use respirators.

Exercises (214):

1. What types of respiratory protection training is the Environmental Health Service responsible for providing?

2. What should you include in the initial use training briefing concerning the worker's workplace?

3. During training, respirator's wearer should be given the opportunity to wear the respirator in a ________________ ________________ ________________.

4. In what ways does EHS provide technical guidance and assistance to industrial shop supervisors?

215. Cite administrative requirements of the respiratory protection program.

Administrative Requirements. As with any program in industrial hygiene surveillance, documentation is a vital element in ensuring that the workers' health or life is safeguarded from harmful air contaminants or oxygen-deficient atmospheres. Documentation of the workers' physical or psychological ability to wear a respirator, training provided, and certification of that training and the proper fit of specific types and models will provide a data base for future aspects of the program in regard to the use of respiratory equipment.

Maintaining standard operating procedures will ensure that personnel are aware of their responsibilities, thus enhancing the overall effectiveness of the respiratory protection program.

Medical evaluations. Adequate medical supervision of respirator users is indispensable in determining the extent of individual stress tolerence and in preventing potential physiological problems. The wearer's psychological limitations must also be evaluated to ascertain that the wearing of respiratory protection will not aggravate an existing condition. Under the best conditions, a degree of anxiety is often encountered when wearing a respirator; such anxiety is exaggerated in emergency situations. Physiological and psychological impairments must be evaluated by a physician to determine whether or not a worker should wear a specific type of respirator. The only practical approach is to treat each case individually and consider the physical burdens imposed by the various types of respirators.

The worker should be evaluated for evidence of respiratory impairments such as emphysema, chronic pulmonary obstructive disease, or bronchial asthma. Air purifying respirators resist inhalation because the filter or cartridge restricts free air flow, and also resist exhalation because the expired air must force open a valve. Thus, a worker with breathing difficulties may not be able to use air-purifying respirators. Therefore, evidence of significant pulmonary disease, if substantiated by reduced vital capacity or reduced forced expiratory volume, may justify forbidding a person to wear a respirator that restricts inhalation and exhalation, and limiting that person to supplied air respirators or work location not requiring respiratory protection. Breathing difficulties should not necessarily prohibit a worker from wearing air-purifying respirators if the worker is comfortable with the fit; however, this must be determined by a physician.

Cardiovascular impairment must be treated with much more concern than pulmonary impairment because of its potentially catastrophic consequences. Workers who have indications of coronary artery disease or angina pectoris (pain about the heart) probably should not wear air-purifying respirators or heavy SCBAs. The same restrictions are recommended for those who have progressive or severe hypertension. Persons who have to use respirators for emergency response should be free of any cardiovascular impairment. Such people would include firemen and emergency response team members who might have to rescue an unconscious 200-pound man from an extremely hazardous environment while wearing a 35-pound SCBA.

Deep facial scars or blemishes, hollow temples, or an abnormally receding chin may spoil the seal of the respirator facepiece. A perforated eardrum, allowing air passage through the eustachian tube into the respiratory tract, may keep a person from working in a toxic environment unless a respirator with a full head enclosure is worn.

All of the above factors can significantly increase the user's workload. Each potential respirator user should be screened (or questioned) for pre-existing medical problems using the following guidelines:

- Lung—history of asthma or emphysema, difficulty in breathing, previously documented lung problems.
- Heart—high blood pressure, artery disease, documented heart problems.
- Other—facial scars, claustrophobia, poor eyesight.

A "yes" answer to any of the preceding medical problems would constitute a warning sign regarding the use of respirators. Further evaluation by a physician is necessary to determine if the worker can perform tasks requiring the use of respiratory devices. If final determination is to forbid respirator use, it must be backed with definitive medical justification.

Recordkeeping. The EHS will maintain an AF Form 2767, Health Training and Fit Testing, by shop, of all personnel attending initial use or supervisory training and fit tested for respirator (Tab F, case file) use. Success or failure of a person to obtain a satisfactory fit with a specific make or model will be annotated in the remarks section of the form. If, during fit testing, it is determined that an individual cannot be properly fitted with any approved respirator, document the SF 600 in the 2100-series health records stating so and recommending further evaluation by a physician. Additionally, if prior fit testing was qualitative, you may want to request quantitative fitting tests, if available in the near vicinity.

Once an individual is trained and successfully fitted, he or she should be issued a respirator certification card (fig. 3-9). This wallet size, locally designed card must include but not be limited to the following: User's name; date and type of training received; type/make, model number, and size of each respirator that fits; medical representative; and medical facility.

Document the SF 600, in the individual's medical record, that he or she is certified in respirator use, including pertinent identifying data of the types and models. This will ensure that an individual will be identified as competent in respirator(s) use by the gaining medical facility upon PCS or TDY. Any discrepancies noted during periodic shop walk-throughs should be annotated on the AF Form 2754, Chronological Record of Workplace Surveillance, maintained in Tab A of the case file. If major discrepancies are noted in the overall evaluation of the respiratory protection program within the shop, a letter of assessment, to include recommedations for corrective actions, should be forwarded to the unit commander and a copy placed in Tab B of the case file.

The shop supervisors should maintain a log of attendance and dates of refresher training. If personnel are individually issued respirators, a record, to include the make and model issued, should be kept in a journal. If respirators are used by more than one person (called common use respirators), the supervisor should designate one person responsible for the issuance of them. This individual must maintain a daily log of each respirator issued for use, replacement parts issued for repair, and devices discarded because they were no longer fit for use. Periodic review of this daily log by the supervisor will prove helpful in the procurement of additional respirators and replacement parts. A monthly record of inspection must be maintained on all emergency use respirators (fig. 3-10) to include inspector's name and signature, noted discrepancies, actions taken to correct those discrepancies, and date of inspection.

Standard operating procedures. Standard operating procedures covering various aspects of the program must be established by the BES, EHS, and the supervisor of each workplace in which respiratory devices are used. In this section we will list some of the important items that should be included in each standard operating procedure.

The BES should implement written procedures to ensure that:

a. The respirators are selected on the basis of hazards to which the employer is exposed.

b. Only approved respirators are purchased and used and that they provide adequate protection for the specific hazard and concentration of the contaminant.

c. Work area conditions and employee exposures are periodically surveyed to determine the continued necessity of respiratory protection or the need for additional protection.

d. The present status of the implementation or repair of engineering controls is known to alleviate the need of respirators.

e. EHS is promptly notified of any work area cited for the use or discontinuance of respiratory devices.

The EHS operating procedures should contain:

a. Provisions for training initial users and supervisors in respirator usage.

b. Criteria for selection; proper fitting test procedures.

c. The medical aspects of respirator usage to include guidelines established for medical evaluations of prospective users and special-purpose periodic exams.

d. Guidelines for periodic shop walk-throughs to assure respiratory devices are used and maintained properly.

e. Methods to document the conduct of the program.

Because EHS is responsible for providing respiratory protection to the units, a task outline for the procurement of respiratory devices and special optical inserts and a method of identification of incoming personnel assigned to tasks requiring respirator use should be provided to the shop.

In general, SOPs written by shop supervisors should include:

a. The issuance of respirators, listing the proper type of respirator for each respiratory hazard.

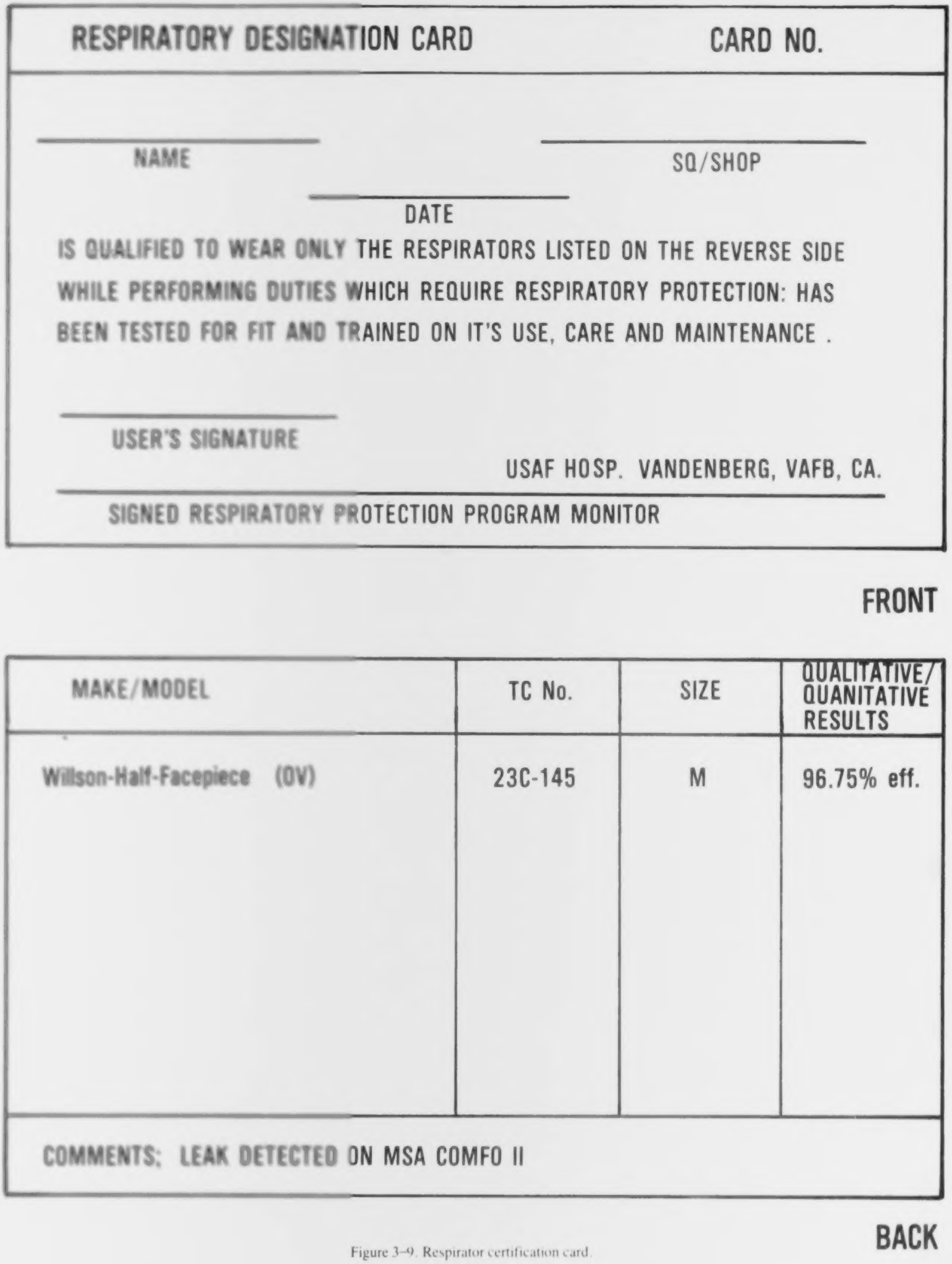
b. Proper use and factors that affect the respirator fit.

c. Inspection and cleaning procedures and frequency.

d. Identification of storage areas.

e. Guidance on maintenance and repair.

If respiratory protective equipment usage in IDLH atmospheres is anticipated, special preparations must be made. An SOP for work in high-hazard areas must be written to cover the following: use of safety harnesses and lines so that workers can be removed from the atmosphere if necessary; designation and provision of a standby individual, equipped with proper rescue equipment, who must be present in a nearby safe area for possible emergency rescue (buddy system); and provisions for



RESPIRATORY DESIGNATION CARD	CARD NO.

NAME ____________ SQ/SHOP ____________

DATE ____________

IS QUALIFIED TO WEAR ONLY THE RESPIRATORS LISTED ON THE REVERSE SIDE WHILE PERFORMING DUTIES WHICH REQUIRE RESPIRATORY PROTECTION: HAS BEEN TESTED FOR FIT AND TRAINED ON IT'S USE, CARE AND MAINTENANCE .

USER'S SIGNATURE ____________

USAF HOSP. VANDENBERG, VAFB, CA.

SIGNED RESPIRATORY PROTECTION PROGRAM MONITOR ____________

FRONT

MAKE/MODEL	TC No.	SIZE	QUALITATIVE/ QUANITATIVE RESULTS
Willson-Half-Facepiece (OV)	23C-145	M	96.75% eff.

COMMENTS; LEAK DETECTED ON MSA COMFO II

BACK

Figure 3–9. Respirator certification card.

communication between persons in the IDLH atmosphere and the standby person. Other important data such as basic toxicologic information and emergency phone numbers also should be included.

Supervisors of workers performing tasks in confined spaces must also write a specific SOP. Confined spaces are defined as enclosures that are usually difficult to get out of, such as storage tanks, missile silos, sewers, tunnels, etc. In many cases, confined spaces contain toxic air contaminants, are oxygen deficient, or both. All confined spaces must be considered to be IDLH unless proven otherwise, so the SOP for confined space entry should contain the same information as one written for respirator usage in an IDLH situation. Additional precautions must be taken to contact BES prior to entry so that tests can be made to determine the presence and concentration of any flammable gas, toxic airborne particulate, vapor, gas, and oxygen concentration; also, that concentration or oxygen percent can be continuously monitored while personnel are working in the confined space. It must also include instructions for force ventilating the confined space if a flammable substance in the explosive range is present. This keeps concentrations well below the lower explosive limit.

When applicable, supervisors should include provisions for use of respiratory protection in low temperatures. The lens in a respiratory inlet covering may fog due to the condensation of the water vapor from the exhaled breath. Written instructions for coating the inside surface of the lens should be provided in areas where workers perform tasks in temperatures approaching 0 °C (32 °F). The instructions should also inform workers to use nose cup inserts in full facepiece equipments that direct the warm and moist air through the exhalation valve without contacting the lens at temperatures below −18 °C (0 °F), but not less than −32 °C (−25 °F). At low temperatures, the exhalation valve can freeze onto the valve seal due to the moisture in the exhaled air. Instructions on unsticking the value should be provided in writing. Special storage procedures should be implemented so that the facepiece will not become stiff or distorted to a degree that may prevent an adequate fit.

Shop personnel should review the SOP prior to performing routine but infrequent operations and tasks in high-hazard areas. SOPs for nonemergency or routine shop procedures should be reviewed periodically to ensure that personnel are knowledgeable of their responsibility in the respiratory protection program.

All SOPs written by shop supervisors will be reviewed by both the EHS and BES for technical accuracy. A copy of each SOP may be placed in Tab E of that shop's case file.

Exercises (215):

1. What medical condition would restrict personnel from using emergency response respiratory devices?

2. List some medical screening guidelines used for an indication of the user's ability to wear a respirator.

3. What information is included on the respiratory certification card?

4. On what AF form would you annotate initial use training and fit testing?

5. Who maintains a daily log of the respirators issued in a shop?

6. A record of inspection is required on what type of respirator?

7. Who will write written procedures to ensure that work area conditions are periodically surveyed?

8. Why would an EHS operating procedure contain provisions for shop walk-throughs?

9. Who will write a task outline for the procurement of respiratory protective devices and optical inserts?

10. Under what conditions should a shop supervisor write additional SOPs?

11. Information for contacting the BES, prior to performing job tasks, would be included in an SOP for working under what condition?

12. Who reviews SOPs written by shop supervisors?

216. Identify procedures for ensuring that a respirator remains effective and fits properly.

Training Format. Selecting the respirator appropriate to a given hazard is important, but equally important is using the selected device properly. The content of the training program can vary widely, depending upon the circumstances. However training of both workers and supervisors must include those points outlined earlier in this chapter, regardless of the circumstances. Although we are

DEVICE: Self Contained Breathing Apparatus (SCBA)   NSN: 4240-697-2529

DATE INSPECTED: 30 Nov 1984   INSPECTED BY: SSgt. Williams

LOCATION: Bldg. 617, Vandenburg, CA   SQ/SHOP: TMS, Missle Maintenance

PERSON RESPONSIBLE FOR MONTHLY INSPECTION: SSgt. Charles Williams

(SIGNATURE) Sgt. Charles Williams

TYPE: Scott   TC. NO. T.C. 13F-39

DEFECTS FOUND:

a. Facepiece

b. Inhalation Valve

c. Exhalation Valve Assembly

d. Headbands

e. Cartridge Holder

f. Cartridge/Canister/[✓ Cylinder] Not fully Charged.

g. Filter

h. Harness Assembly

i. Hose Assembly

j. Speaking Diaphram

k. Gaskets

l. Connections

m. Other Defects Gauge Connector loose.

Guages and emergency devices inoperative.

Corrective Actions: Sent to Fire Department, Extinguisher Maintenance to have the cylinder Charged (30 Nov 84)

1 Dec 84 - Gauges and emergency devices returned to manufacturer for repair.

Figure 3-10. Inspection record for emergency-use respirators.

bound to these training requirements, flexibility may sometimes be appropriate in order to meet individual needs. The training needed by workers who wear respirators daily may differ markedly from that needed by members of emergency response teams.

The extent and frequency of the workers' training depends primarily on the nature and extent of the hazard. If the hazard is a nuisance particulate, for example, the danger from misuse of the respirator is not likely to be serious. However, against highly toxic particulates, a single misuse may have serious consequences.

A major thrust is toward explaining as much as possible about the reasons for wearing a respirator. This of course is to motivate the user to accept the fact that protection is necessary and to instill in him or her the desire to wear and maintain the respirator properly. At best, a respirator may cause discomfort and inconvenience, so there is a natural resistance toward wearing it conscientiously. Much of this natural resistance can be overcome by taking the time and effort to inform the wearer as thoroughly as possible why he or she needs the respirator.

We must also include in our training format the importance of proper maintenance (inspection, cleaning, repair, and storage) and of ensuring that the worker has a good respirator fit. Through stressing the reasons why the respirator is essential and how to maintain and wear it, we will create easier acceptance of respirators and contribute to subsequent correct use.

Maintenance of respirators. Wearing poorly maintained or malfunctioning respirators is, in one sense, more dangerous that not wearing one at all. The worker wearing a defective device thinks he or she has protection when, in reality, there is none. Emergency escape and rescue devices are particularly vulnerable to poor maintenance since they generally are used infrequently and then in the most hazardous and demanding circumstances. The possible consequences of wearing a defective emergency escape and rescue device are lethal.

Probably the most important part of a respirator maintenance program is continual inspection of the devices. If conscientiously performed, inspections will identify damaged or malfunctioning respirators before they can be used.

All respirators used on a routine basis will be inspected for defects before and after each use. Emergency escape and rescue devices shall be inspected after each use and at least monthly. In this case it is highly unlikely that anyone needing a respirator in a hurry, as during an emergency, is going to inspect it. In fact, it could be dangerous to take the time to do so. After cleaning and sanitizing, each respirator should be inspected to determine if it is in proper working condition, if it needs replacement of parts or repairs, or if it should be discarded.

Respirator inspection should include a check for tightness of connections; for the condition of the respiratory inlet covering, head harness, valves, connecting tubes, harness assemblies, filters, cartridges, canisters, end-of-service-life indicator, and shelf-life date(s); and for the proper function of regulators, alarms, and other warning systems. Each air and oxygen cylinder shall be inspected to ensure that it is fully charged before the device is returned to service.

Because respirator cleaning usually involves some disassembly, it presents a good opportunity to examine the respirator thoroughly. If any defect is found, the device should be repaired on the spot or removed from service until it can be repaired.

Cleaning and sanitizing. Each respirator must be cleaned and sanitized to ensure that the respirator wearer is provided with a clean and sanitized respirator at all times. A respirator that is used by more than one particular worker, such as those issued for emergency escape or rescue, should be cleaned and sanitized after each use. Although in some cases a worker may not be required to maintain respirators used by the shop, briefings on the cleaning procedures should be provided. Such briefings will encourage worker acceptance of the respirator by providing assurance that he or she always receives a clean, disinfected, properly maintained device.

The actual cleaning may be done in a variety of ways. Any good detergent may be used, but many commercial cleaner and sanitizer solutions that clean effectively and contain a bactericide are available. The bactericide is generally a quaternary ammonium compound, which has some disadvantages because its concentration must be adjusted to the composition of the local water to provide a constant degree of disinfection. Also, there is a possibility of dermatitis if the quaternary ammonium salts are not completely rinsed from the respirator. Personnel opting to use commercial solutions containing quaternary ammonium compounds should be cautioned as such and advised to strictly follow the manufacturer's instructions for use. An alternative is to wash the respirators in a detergent followed by a disinfectant rinse. Reliable, effective disinfectants may be made from readily available household solutions.

To avoid damaging the rubber and plastic in the respirator facepieces the cleaner and disinfectant solutions should be warm (not to exceed 120 °F) to ensure adequate cleaning. The cleaned and disinfected respirators should be rinsed thoroughly in clean water (of the above recommended temperature) to remove all traces of detergent, cleaner and sanitizer, and disinfectant. This is very important to prevent dermatitis.

The respirators must be allowed to air-dry on a clean surface, then reassembled and inspected. When inspecting a respirator that has just been cleaned, special attention should be focused on detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve and can cause valve leakage or sticking.

Respirators may become contaminated with toxic materials. If the contamination is light, normal cleaning procedures should provide satisfactory decontamination; otherwise, separate decontamination steps (e.g., washing the respirator with an alkaline soap and rinsing with an ethyl alcohol for organic phosphate pesticides contamination) may be required before cleaning.

Part replacement and repair. There should be no problem repairing most respirators, particularly the most commonly used air-purifying types. Replacement parts should be only those designed for the specific respirator being repaired and done only by persons trained in proper respirator assembly.

Personnel must be aware of their limitations and never try to replace components or make repairs and adjustments beyond the manufaturer's specifications, unless they have been especially trained by the manufacturer. These restrictions apply primarily to maintenance of the more complicated devices, especially open-circut SCBAs. Reducing or admission valves, regulators, and alarms on complicated devices must be returned to the manufacturer or to a trained technician (trained by the manufacturer) for repair or adjustment.

An important aspect of any maintenance program is having enough spare parts on hand. Supervisors should be urged to practice continual surveillance of replacement rates to determine what parts in what quantities must be kept in stock.

Storage. All the care that has gone into cleaning and maintaining a respirator can be negated by improper storage. Respirators should be stored in a manner that will protect them from dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals. It is also very important that the respirator be protected from mechanical damage. Leaving a respirator unprotected on a workbench or in a tool box among heavy wrenches and other tools may damage it.

It is strongly recommended that the respirators be placed in reusable plastic bags until reissue. They should be stored in a single layer with the facepiece and exhalation valve in a normal position to prevent the rubber or plastic from taking a permanent distorted shape (fig. 3-11). Note that the respirator in lower right corner of storage cabinet is stored improperly. The storage cabinet should be readily assessable and all workers made aware of its location.

Avoidance of serious injury from inhalation of a toxic substance may depend entirely on how quickly a worker can get to an emergency-use respirator. The respirators should be stored in a container specially designed for its storage and clearly marked to show its contents. The locations should be well known but in an area that will predictably remain uncontaminated. Even highly trained workers may take 30 seconds to 1 minute to don a respirator. In a highly contaminated atmosphere such as might be created by a massive release of toxic material, this may be too long to stay in the area. Therefore, the first reaction should be to escape to an uncontaminated area; then put on the respirator that should be located there and re-enter the hazardous area for whatever task must be done.

Providing adequate training will cause workers to develop a sense of respect for their respirators which will automatically enhance incentive to protect them from damage. Encourage all supervisors to develop an in-house maintenance program to suit the needs of the worker without causing any unjustified inconvenience. In doing so each worker will find it normal routine to properly care for the respirator he or she used that day.

Fit and leak testing. All the care that went into the design and manufacture of a respirator to give maximum efficiency will not protect the wearer if there is an improper match between facepiece and wearer or improper wearing practices. The problem is two-fold. Assuming that more than one brand of a particular type is available, the first problem is to determine which brand fits best. The second problem is to ensure that the user knows when the respirator fits properly.

Determination of facepiece fit could involve both qualitative and quantitative tests. A quantitative test involves the use of analytical equipment to detect actual facepiece leakage. A qualitative test may use banana oil or irritant smoke and the subjective opinion of the wearer to determine a good fit. Ensuring that the wearer has a good fit involves, upon each donning, a negative and positive pressure check used to give a crude confirmation of the respirator fit before entering a potentially hazardous atmosphere. No respirator marketed will fit everyone. Therefore, supervisors should be urged to purchase various brands of a given type of respirator to take advantage of the different fitting characteristics of each. In this way, the chances of properly fitting all workers are increased. Equally important is the fact that having more than one facepiece to choose from gives the worker a better chance of finding a respirator that is reasonably comfortable while providing good protection.

There are certain factors that prevent the seal of the respirator. When any of the following conditions exist, the worker must not be permitted to wear a respirator:

a. Hair that passes between the face and the sealing surface of the facepiece (stubble, moustache, sideburns, beard, low hairline, bangs).

b. Hair that interferes with the function of the respirator valve (moustache, beard).

c. A spectacle that has temple bars or straps that pass between the sealing surface of a respirator full facepiece and the wearer's face.

d. A head covering that passes between the sealing surface of the facepiece.

e. The wearing of an eye or a face protective device that interferes with the seal of a respirator (welding helmet, faceshield, goggle).

f. If scars, hollow temples, excessively protruding cheekbones, deep creases in facial skin, the absence of teeth or dentures, or unusual facial configurations prevent a seal of respirator facepiece to a wearer's face.

Prior to performing the selected fitting test on an individual, he or she should be instructed in the correct procedures for quality assurance test. There are two of these tests: the negative and the positive pressure tests.

Negative pressure test. This test merely consists of closing off the inlet of the canister, cartridge(s), or filter(s) by covering with the palm(s) or replacing the seal(s), or of squeezing the breathing tube so that it does not pass air; inhaling gently so that the facepiece collapses slightly; and holding the breath for 10 seconds (fig. 3-12). If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough. This test, of course, cannot be used on respirators with loose-fitting inlet coverings, such as hoods, helmets, blouses, or full body suits; rather, it should be used only on tight-fitting inlet coverings such as the facepieces.

Positive pressure test. This test is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece

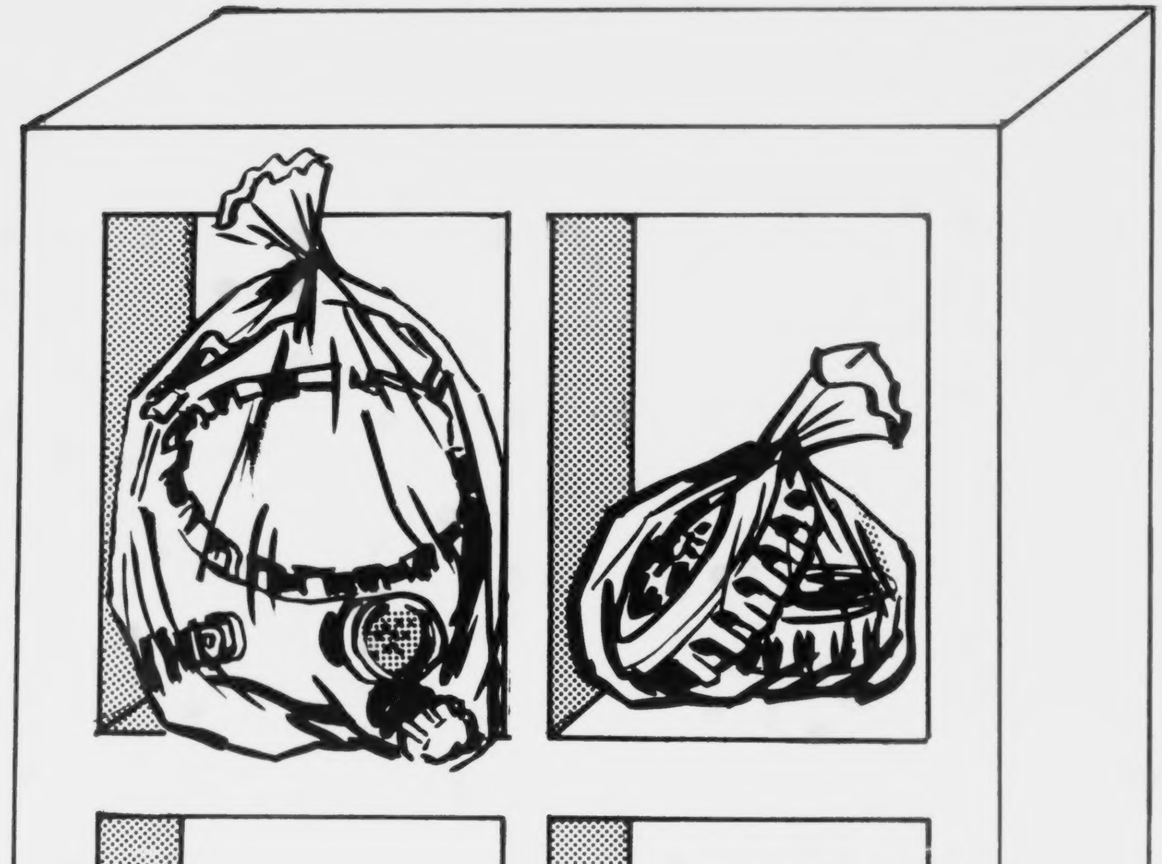


Figure 3-11. Storage compartment for respiratory protective devices.

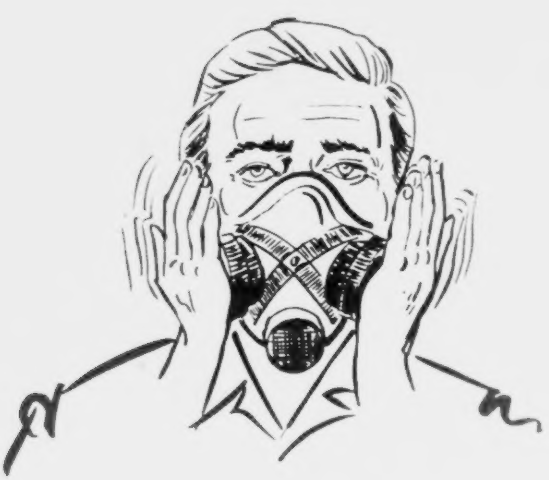


Figure 3-12. Negative pressure check.

without any evidence of outward leakage (fig. 3-13). In some respirators, this requires removing the exhalation valve cover and replacing it after the test, often a most difficult task. Removing and replacing the exhalation valve cover often disturbs the respirator fit.

These quality assurance tests should be done each time the wearer dons the respirator as a determination of fit. If a proper seal cannot be demonstrated, the individual should readjust the headstraps and facepiece and repeat the test.

During the fitting test (qualitative or quantitative), the worker should carry out a series of exercises which simulate work movements. A leak at any time during this multiposition test procedure shall be cause to stop, refit the mask, and reaccomplish the entire procedure.

For a respirator equipped with a facepiece the exercises must include but not be limited to:

- Normal breathing.
- Deep breathing.
- Turning head from side to side.
- Nodding head up and down.
- Talking.

For a respirator equipped with a helmet, hood, or suit, the exercises must include but not be limited to:

- Standing still, arms hanging downward along sides of body, normal breathing.
- Bending forward and touching toes.
- Raising arms above head and looking upward.
- Bending knees and squatting.
- Standing while holding a tubular rod about 76 centimeters in length with hands approximately 30 centimeters apart, twisting torso from side to side in an 180° arc, and slowly raising the arms from a downward direction to an upward direction having an angle of 45° with the horizontal plane.
- Running in place (or deep breathing).

Qualitative fitting test. The results of this fitting test rely on the worker's subjective response. Generally, it consists of creating an atmosphere containing an odorous vapor or irritant smoke around the wearer of an atmosphere-supplying or air-purifying respirator. When an air-purifying respirator is tested, it should be equipped with a cartridge, canister, or filter that removes the testing element from the air.

The irritant smoke test atmosphere is created by air flowing through a commercially available smoke tube normally used by the BES personnel to check the performance of a ventilation system. The respirator wearer should keep his or her eyes closed during the test if the respirator does not offer eye protection. This test must be performed with proper safeguards because the particulate is highly irritating. You would lightly puff smoke over the respirator starting about 2 feet from the respirator (fig. 3-14). If the wearer does not detect penetration of smoke into the respirator, move the smoke tube closer and observe the wearer's reactions. When the smoke tube has been moved within 6 inches of the respirator and penetration has not occurred, direct the smoke at potential points of leakage; then have the worker perform the multiposition test procedures. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing.

The odorous vapor test atmosphere is commonly created by using isoamyl acetate, which has a pleasant, easily detectable odor. The simplest method of carrying out the test is to saturate a piece of cloth, sponge, or cotton swab with the liquid and pass it near the sealing surface, taking care to avoid the skin. A stencil brush filled with isoamyl

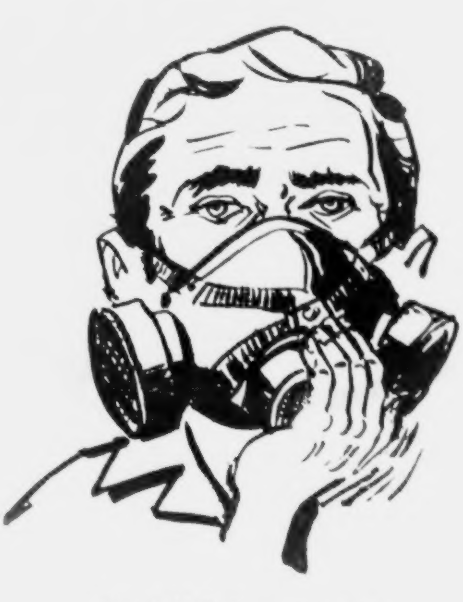


Figure 3-13. Positive pressure check.

acetate can be used in the same manner (fig. 3-15). Have the wearer perform the multiposition test and if unable to detect the odor, he or she has achieved a satisfactory fit with the respirator.

Another method of the qualitative fitting test using isoamyl acetate as the test agent may be carried out using a hood, chamber, or room containing a known concentration of the liquid in the air. The concentration commonly used is 100 ppm by volume. The wearer enters the enclosure containing the test atmosphere and performs the multiposition test procedure. Again, if no odor is detected the respirator fit is acceptable.

The use of isoamyl acetate vapor as a test agent has the following two major drawbacks: the odor threshold varies widely among persons, although most persons can detect by odor a concentration of isoamyl acetate vapor in air as low as 0.1 parts per million by volume; and olfactory fatigue may cause a person to fail to detect the odor of a low concentration of isoamyl acetate vapor in air. Before performing this test, all persons should be tested to determine their ability to sense the odor of isoamyl acetate vapor in air. Since the odorous vapor test is subjective, the validity of the test result depends on honest indication by the respirator wearer as to whether or not an odor was detected during the test.

Quantitative fitting test. All quantitative fitting tests (fig. 3-16) involve exposing the respirator wearer to a test atmosphere containing an easily detectable, relatively nontoxic aerosol, vapor, or gas as the test agent and then measuring the penetration of the test agent into the respirator. While wearing the respirator in the test atmosphere, the respirator wearer performs the multiposition test procedure. The respirator is equipped with a sampling probe (fig. 3-17) which is connected by means of flexible tubing to an instrument that measures the penetration of the test agent into the respirator. Quantitative respirator fitting tests can be used for both air-purifying respirators and atmosphere-supplying respirators. When carrying out a quantitative respirator fitting test that uses an aerosol as the test agent, it is an acceptable procedure to equip an air-purifying respirator with a high-efficiency filter. When carrying out a quantitative respirator fitting test that uses a vapor or gas as the test agent, it is an acceptable procedure to equip an air-purifying respirator with an appropriate cartridge or canister that removes the vapor or gas from the air.

Most people will experience some apprehension when any respirator is placed on their face for the first time. This response is most common with full-face respirators because of the restricted vision. This feeling will usually disappear

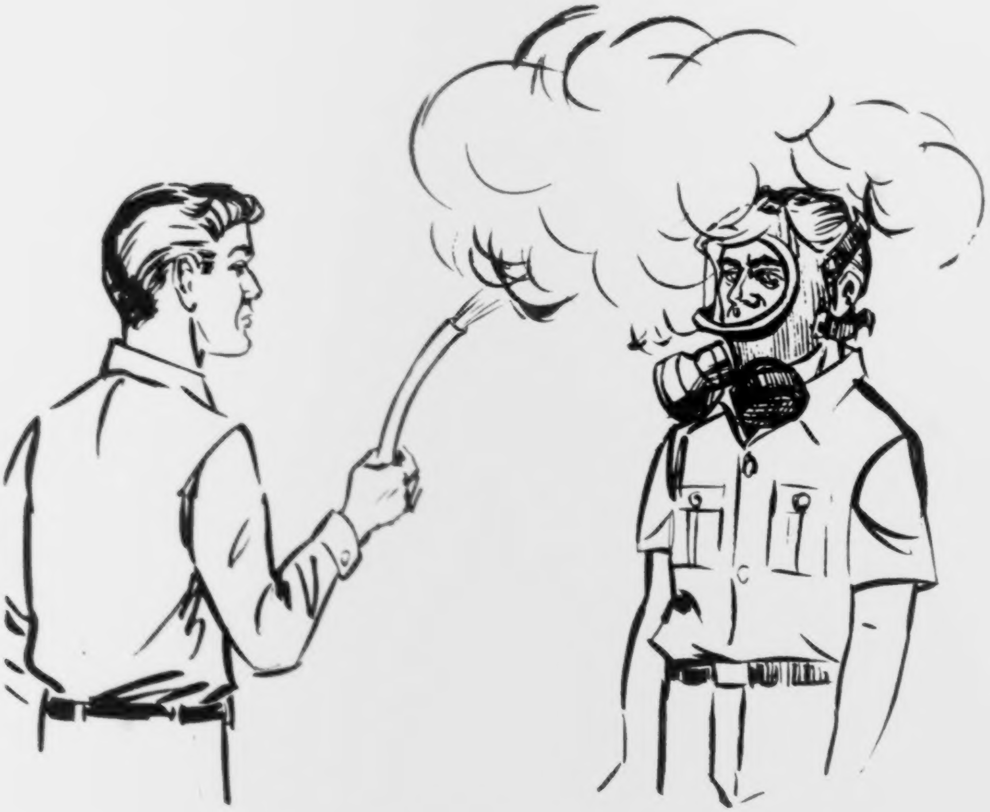


Figure 3-14. Procedure for irritant smoke test.

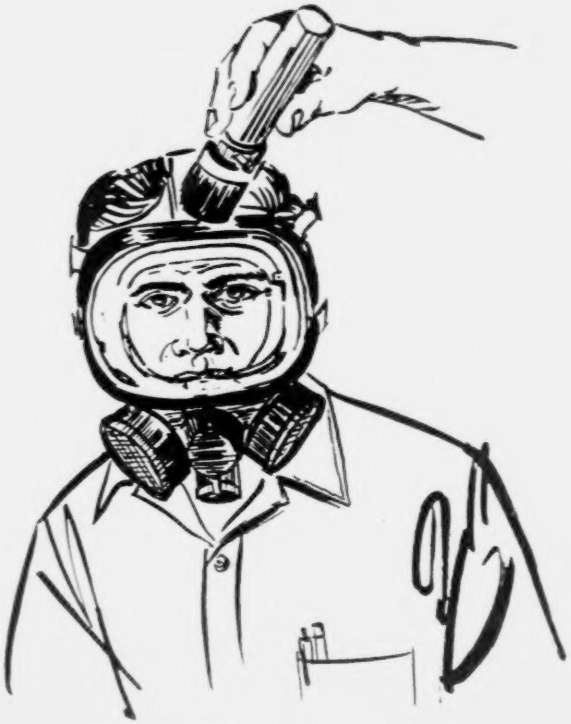


Figure 3–15. Qualitative fitting test using isoamyl acetate.

with proper training and when the wearer develops confidence in a respirator.

However, some people will panic when placed in a stress situation that might exist when a tight-fitting respirator covers the face or when a person is being confined in a small testing chamber. If people who are being fitted show signs of anxiety, such as rapid breathing (hyperventilating), paling skin color, fearful appearance, or profuse sweating, the test should be terminated immediately and the respirator removed.

Our overall training efforts should lead to the wearer's acceptance of the respirator. Numerous factors affect the acceptance of respirators. These factors include: comfort, resistance to breathing, fatigue, interference with vision and communication, restriction of movement, interference with job performance, and confidence in the effectiveness of the respirator to provide adequate protection.

Periodically, EHS personnel should visit the workplace and consult respirator wearers about their acceptance of the equipment. Even though we may not be responsible for providing refresher training, it is important that we do not view our responsibilities as merely a once-only instructional course, but rather as a continual reenforcement to our entire occupational health program.

Exercises (216):

1. What is the purpose of inspecting respirators?

2. Why should caution be used when cleaning and sanitizing respirators with solutions containing quaternary ammonium compounds?

3. How can detergent or soap residue affect the exhalation valve?

4. Why should supervisors purchase a variety of brands of a given type of respirator?

5. In what ways would a beard or moustache restrict a worker from wearing a respirator?

6. With what type of respiratory inlet covering is the negative pressure test recommended?

7. Why should precautions be used when using irritant smoke as a testing agent?

8. What is an advantage in using an irritant smoke as a testing agent for qualitative fitting test?

9. What should you do if a person being fitted with a respirator starts hyperventilating?

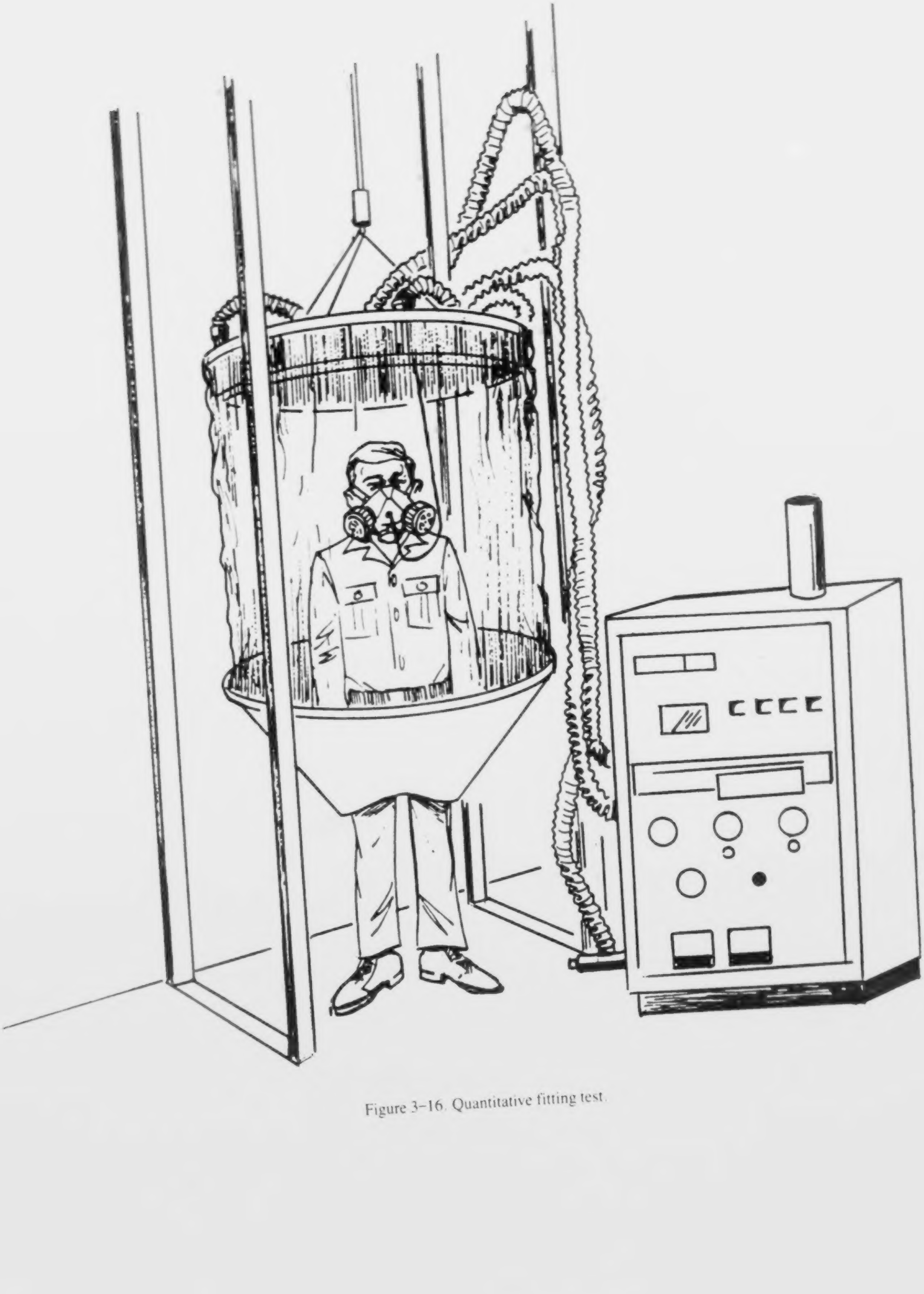


Figure 3-16. Quantitative fitting test.

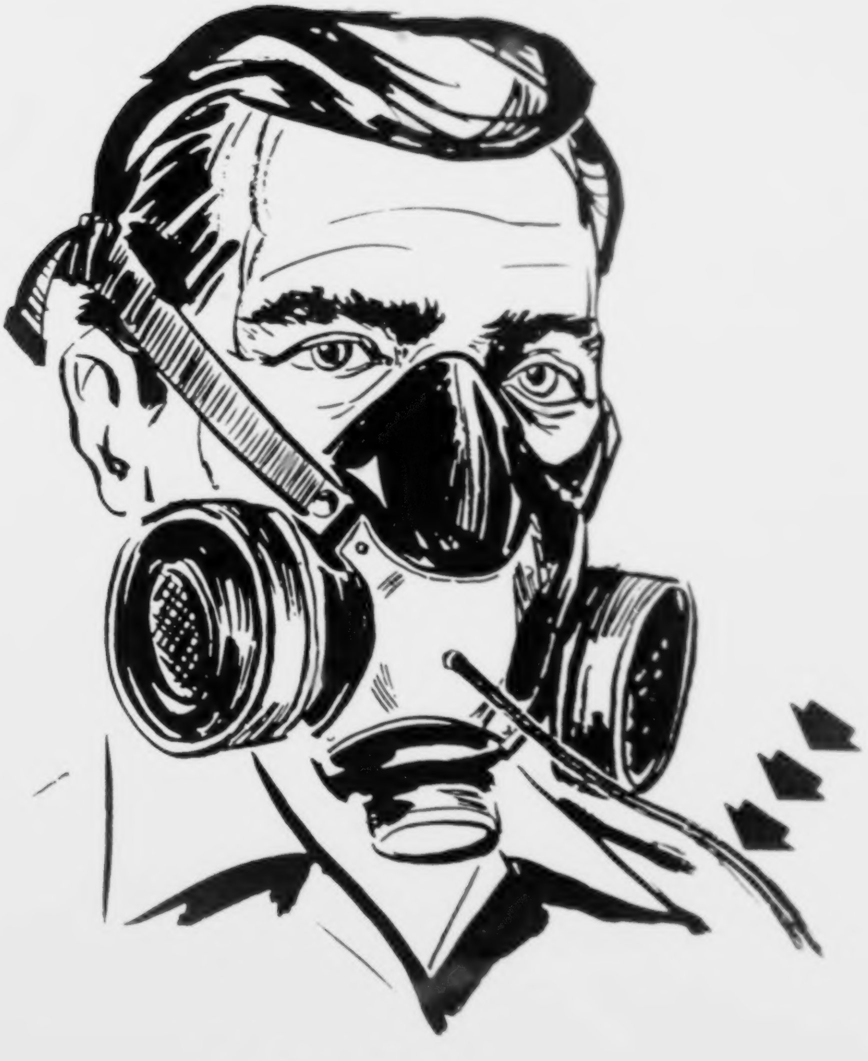


Figure 3-17. Respirator mask used for quantitative fitting test

Hearing Conservation

THE HUMAN hearing mechanism is very complex—and so it should be. Our ears are capable of perceiving and processing a multitude of acoustic stimuli. A normal ear can perceive sounds within a frequency range from about 20 to 20,000 Hz (Hertz, or cycles per second). Within this very wide range of frequencies, the human ear can also perceive and process a tremendous range of intensities.

Since prevention of noise-induced hearing impairments depends on the self-motivation possessed by each individual who is exposed to potentially hazardous noise levels, the need for education, supervision, and self-discipline is significant. The availability of ear protection devices, careful audiometric monitoring, and employment of stringent auditory damage-risk criteria are of little value unless each individual who is exposed to potentially hazardous noise is sufficiently self-motivated to protect his or her hearing. Normally, this motivation is not initiated by internal needs or demands. Instead, it is initiated by externally applied forces of persuasion which convince all employees who work in noise that only they can prevent a noise-induced hearing loss.

In theory, external motivational forces are instigated by the base commander, through each supervisor down to the person who actually works in a hazardous noise environment. Supervisors, especially immediate supervisors, must continually practice and enforce the use of personal ear protection devices. Usually, the compliance with safety regulations, such as the required use of ear protectors, reveals itself in daily work situations by the degree of emphasis placed on them by the supervisor.

The base commander and the director of base medical services (DBMS) can place a lot of emphasis on hearing conservation measures, but it really is each worker who determines if this program is successful or not. Each employee who must work in noise must take the necessary precautions to protect his or her hearing. Your job is to inform workers of what effect noise may have on their hearing and how they can protect it.

4-1. Education of Noise Exposed Personnel

Occupational health education for noise-exposed employees must be conducted at various levels, ranging from expansive base-wide education programs to the informal education of each individual. The overall effectiveness of these various educational sessions depends on one essential factor—how convinced are all employees that they alone can ensure that a noise-induced hearing loss will not occur. For this reason, all attempts at educating the population of noise exposed personnel must be aimed directly at the individual. Simply stated, the purpose of the USAF Occupational Health Education Program is to convince each individual that, "You may lose your hearing if you do not protect yourself every time you enter a hazardous noise area." Once each person is thoroughly convinced that unprotected exposures to noise may result in hearing loss, then the teaching of how to properly wear and care for personal hearing protection devices can be accomplished.

217. Cite principles of education of noise exposed personnel.

Prior to Noise Exposure. When and where should the occupational health education of persons who are newly exposed in hazardous noise be accomplished? Logically, before exposure each employee who is going to work in hazardous noise areas should have a thorough understanding of the undesirable effects of noise and the proper use and care of ear-protection devices. This initial orientation should be done during the first few days of exposure. It is the responsibility of the DBMS to ensure that every newly arrived or reassigned individual who will work in hazardous noise areas visit the appropriate medical section where the following actions are taken. If a reference audiogram has not already been made then one must be done within 30 days, DD Form 2215 completed, and the person scheduled for a 90-day followup examination. Then, once a year, an audiometric examination must be completed and the test results and other pertinent information entered on DD Form 2216. Copies of all audiometric examinations administered in support of the USAF Hearing Conservation Program should be forwarded to the USAF Hearing Conservation Data Registry at Brooks AFB, Texas.

Each exposed individual should be fitted with insert-type earplugs and instructed in their use, care, and hygiene. Each employee should receive a brief, but carefully planned orientation concerning the undesirable effects of noise and the need for ear-protection devices. Finally, the individual's name must be recorded on a roster that is sent to the appropriate military/civilian personnel office on the base for automatic notification when the annual audiometric examination is needed. Automated notification of military and civilian personnel should be used for scheduling employees for routine annual audiometry. The scheduling of your occupational health education classes should be automated whenever possible.

During Noise Exposure. When and where should personnel already exposed to noise be scheduled for occupational health education classes? Personnel who work in noise should receive additional instruction when they return to the medical facility for their required 90-day or annual audiometric examination.

Environmental health services or the base audiologist should ensure that appropriate safety personnel perform routine inspections of areas where known hazardous noise duties exist. This inspection should include "spot checks" of employees and supervisors who work in hazardous noise. Each individual who is in hazardous noise but not wearing protection should be identified and cited with the circumstances noted. The need for ear protection should be emphasized and the supervisors of the individual(s) should be notified with the recommendations that the appropriate administrative action be taken.

Hearing protection devices should be refitted or replaced if necessary at the medical facility during the annual examination. Many of the most motivated noise exposed persons acquired this motivation from being convinced that wearing ear protection not only reduces the potential hazard, but also that they can hear and communicate in noise more effectively and that their tasks are more easily and comfortably accomplished when the noise is reduced by the use of ear protectors.

Formal/Informal Training. What should noise-exposed employees know about noise? Formal and informal educational programs should be carefully planned to provide specific facts and establish a basic insight concerning the undesirable effects of noise. The specific contents and approaches are determined according to the responsibility level of the student. Occupational health education classes at both the supervisor and individual employee levels are essential if the effectiveness of the overall USAF hearing conservation program is to be realized.

Supervisor training. Supervisors must be thoroughly knowledgable about all the undesirable effects of noise and the requirement for and the proper use and care of ear-protection devices. All supervisors must realize and accept the responsibility for ensuring that their employees recognize the need for ear protection and that they properly use the protectors when exposed.

The supervisor must evaluate each employee's acceptance and use of personal ear protectors. When rating the overall performance and work proficiency displayed by a subordinate, the supervisor must consider noise as a work hazard and the use of ear protectors as a required safety device. If an employee works in hazardous noise and does not utilize ear protection and/or other noise control measures, then this should be indicated or reflected in that person's overall effectiveness rating or evaluation.

Supervisors should accomplish periodic safety checks on all subordinates to ensure that they are following hearing conservation and safety regulations or directives.

When indicated, supervisors should refer subordinates to the appropriate medical facility for their scheduled audiometric examination, refitting of earplugs, and other medical assistance.

It is the responsibility of each employee to routinely inspect the condition of his or her personal ear protection devices (earplugs and/or ear muffs) and ensure that the devices are functioning properly. If replacements or maintenance are required, the supervisor should initiate appropriate corrective action.

The supervisor should maintain records that indicate the type of ear protection devices required. He or she must ensure that the devices issued are compatible with the work or tasks the individual must perform and provide the appropriate amount of noise attenuation. If ear muffs are indicated and are considered appropriate, the supervisor should institute appropriate action to ensure that they are ordered and issued.

Supervisors should request that the bioenvironmental engineering section evaluate the noise exposures to which subordinates are routinely exposed. Only those who must work in hazardous noise, as determined by the supervisor, should be allowed access to such areas.

Individual training. The true effectiveness of the USAF Hearing Conservation Program depends on the motivation and conviction each individual who is exposed to potentially hazardous noise possesses. Each person who is exposed to potentially hazardous noise should know the following:

a. Repeated unprotected exposure to potentially hazardous noise may cause permanent damage to the inner ear. A loss in hearing due to unprotected exposure to noise, especially during initial exposures, produces a deterioration in hearing acuity which is not apparent to the individual. Hearing loss due to noise is insidious, and by the time the injured employee becomes subjectively aware of the hearing loss, the degree of impairment may be severe. Loss in hearing due to noise cannot be corrected by medical or surgical methods. However, in advanced cases a hearing aid may be of significant benefit.

b. Noise-induced hearing loss can be prevented. The proper use of personal ear protection every time one enters hazardous noise areas can prevent the occurrence of such losses.

c. An individual who possesses relatively normal hearing can determine when he or she is in potentially hazardous noise by employing the following test: If you have to shout to be understood at a distance of 3 feet, (approximately arms length) you are probably in a hazardous noise area.

d. Every person should report possible hearing or noise problems to his or her immediate supervisor who should seek assistance from medical personnel at the medical facility.

e. Each employee should be informed about which types of protection devices are available. They should be given an opportunity to select which type(s) they prefer and then be thoroughly trained about their proper use and care.

Consultative assistance. Guidance concerning the conduct of formal and informal education programs can be obtained by contacting the Audiology Function (NGFA) of the USAF School of Aerospace Medicine, Brooks AFB TX 78235-5000 (AV 240-2177), from which professional guidance as well as specially prepared visual and auditory aids are available. Several very effective Air Force training films such as "The Hazards of Noise," can also be requested through each base film library or service for use in conducting training sessions. Guidance concerning the directives or management of the USAF Hearing Conservation Program or the referral of patients to USAF hearing conservation diagnostic centers can be obtained by contacting the USAF Hearing Conservation Data Registry, USAF Occupational Environmental Health Laboratory, Brooks AFB, TX 78235-5000 (AV 240-2909 or 2940).

Exercises (217):

1. When should personnel receive education concerning the adverse effects of noise on their ears?

2. Briefly state some key points included in supervisor training.

3. What does the effectiveness of the USAF Hearing Conservation Educational Program depend upon?

4. What items should be included in training of employees about hearing conservation?

5. Who can give you further guidance on how to conduct formal and informal education briefings?

4-2. Ear Protection

The Air Force has recognized the need for the mandatory use of personal ear protectors by those who routinely work in noise as far back as August 1949. At that time the Air Force Surgeon General published AFR 160-3, *Precautionary Measures Against Noise Hazards*. Earplugs were issued to all personnel who encountered potentially hazardous noise. This regulation also directed that research be performed to define auditory risks and that pure-tone audiometry be used to monitor the hearing of personnel who work in hazardous noise. Much has been learned since the summer of 1949.

Day-to-day long-term unprotected exposures to hazardous noises represent a real threat to unprotected ears. Personal ear protectors can serve to guarantee that routine and even infrequent encounters with potentially hazardous noises do not result in permanent sensorineural hearing losses. The following material is intended to clarify several technical and behavioral factors related to the use of personal ear protectors.

218. Specify the types and advantages of personal ear protection.

Advantages. Several advantages are associated with the use of personal ear-protective devices. Some of these advantages include:

- Prevents auditory fatigue or temporary threshold shifts (TTS).
- Prevents permanent threshold shifts (PTS).
- Reduces general fatigue.
- Reduces annoyance and emotional irritation.
- Increases work performance and efficiency.
- Lets people engage in activities that would otherwise damage their hearing.
- Improves the ability to hear in the presence of interfering noise.

Auditory fatigue. Exposures (protected or unprotected) to noise that result in auditory fatigue should be considered excessive. Although research has failed to correlate specific amounts of temporary shifts directly with amounts of subsequent permanent shifts, there is no doubt that temporary shifts due to noise do reflect the fact that the auditory system has been overexposed to noise. Anytime that TTS is observed following exposure to potentially hazardous magnitudes of noise, it is safe to assume that the observed effect is undesirable. Audiometric monitoring of the hearing thresholds of those who work in hazardous noise is the only way to determine that a permanent decrease in auditory sensitivity has occurred.

Permanent hearing loss. The primary range of hearing that reflects permanent changes in acuity due to excessive noise exposures is first evident above 2000 Hz, with the greatest change at 4000 Hz. Eventually the 2000 and 1000-Hz ranges will begin to suffer. When the patient experiences two or more significant decreases (these are described in a later section) in hearing sensitivity, he or she should be referred to a USAF hearing conservation diagnostic center. Hearing loss from noise usually occurs bilaterally. However, when only one ear reveals a hearing loss, then the patient should be referred to a USAF hearing conservation diagnostic center (AFR 160-53) where advanced auditory tests can be administered to accurately define the cause.

General fatigue. General fatigue results from working in the presence of excessive noise. This type of response may be due to general mental-physiological stress that is directly related to excessive noise exposures. Frequently, noise that causes an individual to increase vocal efforts in order to effectively communicate may cause general, if not specific, fatigue. If the nature of the job requires people to communicate in the presence of noise, then the need to raise the voice to effectively communicate may result in fatigue. This type of fatigue is generalized to the extent that the person involved is more tired than generally expected at the end of the work period. However, those who routinely wear ear protectors report that they perceive less fatigue at the end of a work period than similar periods of work when no ear protection is worn.

Annoyance. Noise may elicit annoyance or irritation. This type of behavior is subjective and difficult to define. Many workers who start wearing ear protection devices discover that they are less annoyed or irritated at the end of a work period during which they wore earplugs or ear muffs. This type of subjective response is not easy to verify; however, general comments made by workers should not be ignored.

Improved work performance. Personnel who routinely wear ear protectors demonstrate improved performance and work efficiency. This phenomenon has been observed throughout the years but still lacks defined scientific evidence. Scientific evidence is dependent on behavioral responses that are difficult to quantify.

Enhanced outside activities. Off-duty activities, which may include recreational activities or "moonlighting," may involve exposures to potentially hazardous noise. Since the accumulation of sequential exposures to noise may result in a noise-induced hearing loss, all on- and off-duty activities must be considered. High-intensity noise, whether on or off duty, when combined, may result in a permanent sensorineural hearing loss. The wearing of personal ear protection is essential, particularly for those who work in noise and encounter additional recreational exposures (i.e., hunting, loud music, etc.). Auditory risk limits established by the military generally assume that those who work in potentially hazardous noise will obtain a period of "auditory rest" before the next exposure.

Improved hearing in noise. One of our most serious concerns is the question of whether people who wear ear protectors will be able to hear warnings, signals, and speech (particularly crying for help). Frequently, people believe that if they put earplugs in their ears they could not hear what others say or alarm signals. This is not the case. As we stated previously, people who wear ear protectors can actually hear and understand the desired signals in noise easier than without the use of ear protectors. Earplugs, similar to sun shades which exclude the glare of light and make it easier to see, make it easier to hear in the presence of loud noise.

Earplugs serve as filters that quite effectively reduce noise present within the mid and high frequencies (i.e., above about 1000 Hz). Ear-protection devices, such as earplugs and ear muffs, provide the least amount of attenuation in the lower range of frequencies.

Generally, earplugs or ear muffs reduce the amplitude of noise approximately 20 dB. When worn in combination (earplugs and ear muffs), the amount of noise reduction is not additive. Generally, if a plug or muff each yields attenuation of about 20 dB, then when worn in combination the amount expected, will be about 30 dB.

If in intense noise, wear maximum ear protection. The basic rule that applies to hearing while wearing ear protectors is: "If you are in a noise that would make it difficult to hear voices or warning sounds, then your chances of hearing those desired signals are actually enhanced when you wear the protective devices."

If the magnitude of a noise is so great that it interferes with speech communication, then it may constitute an auditory risk to unprotected ears. Most people who attempt to communicate in the presence of high-intensity noise tend to regulate the level of their voice to compensate for the interfering effect of the noise. The only way to protect their hearing and allow for effective communication is to have all exposed workers wear ear protectors. Most workers will automatically compensate by using an appropriate vocal effort to overcome the attenuation by the ear protectors.

Occasionally, an individual will complain that wearing ear protection makes it more difficult to hear and understand speech in the presence of noise. There are two possible reasons for these complaints. One is that the noise is not intense enough for ear protection to be required. Ear protection can cause speech interference when the noise level is less than about 85 dBA. While ear protection might be desired in those circumstances, its use should be discontinued if critical speech communication will be missed. A second possible reason is that the person already has a substantial hearing loss. In this case, the alternatives are to find another means of communication or to remove the individual from those duties. Discontinuing ear protection use would simply aggravate and accelerate the problem.

Types of Hearing Protective Devices. In accordance with AFR 161–35, the director of base medical services (DBMS) must ensure that all military and civilian personnel who are exposed to potentially hazardous noise are issued or fitted with personal ear-protective devices. In addition, each individual who is issued such devices must be thoroughly indoctrinated in their use and care. Figure 4-1 illustrates the major types of personal ear-protection devices.

Personal ear-protection devices include the insert-type earplug, semi-insert devices, ear muffs, communication muffs, headsets, and noise helmets.

Insert earplugs. Both premolded and hand-formed earplugs are available as standard items. The two types of premolded devices available are the V–51R (single flange) and the Com-fit (triple flange). Available hand-formed earplugs include wax impregnated devices (flents) and foam cylinders (E–A–R). These are all medical items and are generally issued only by medical personnel. Medical personnel should review such procedures to ensure that adequate instructions are being provided when the plugs are issued. The Vis available in five sizes, making it possible to fit at least 90 percent of any population. Fitting is critical. Earplugs will be of little value unless the person can correctly insert them. An earplug must create an air-tight seal in the ear canal if it is to be successful. Premolded and hand-formed earplugs are about equally effective if they are used correctly. All types of earplugs should be available and every effort made to provide each individual with the type that he or she prefers.

Semi-insert devices. These are relatively large plug-like devices that are held in place with a headband. The plugs are intended to cover up the ear canal entrance rather than be inserted. These are listed as "Not Available to Air Force" in the supply catalog even though they occasionally find their way into Air Force facilities. Semi-inserts should not be routinely used in noise environments that contain overall levels that exceed about 90 dBA weighted.

Ear muffs (nonelectroacoustic devices). Ear muffs represent another type of ear protective device.

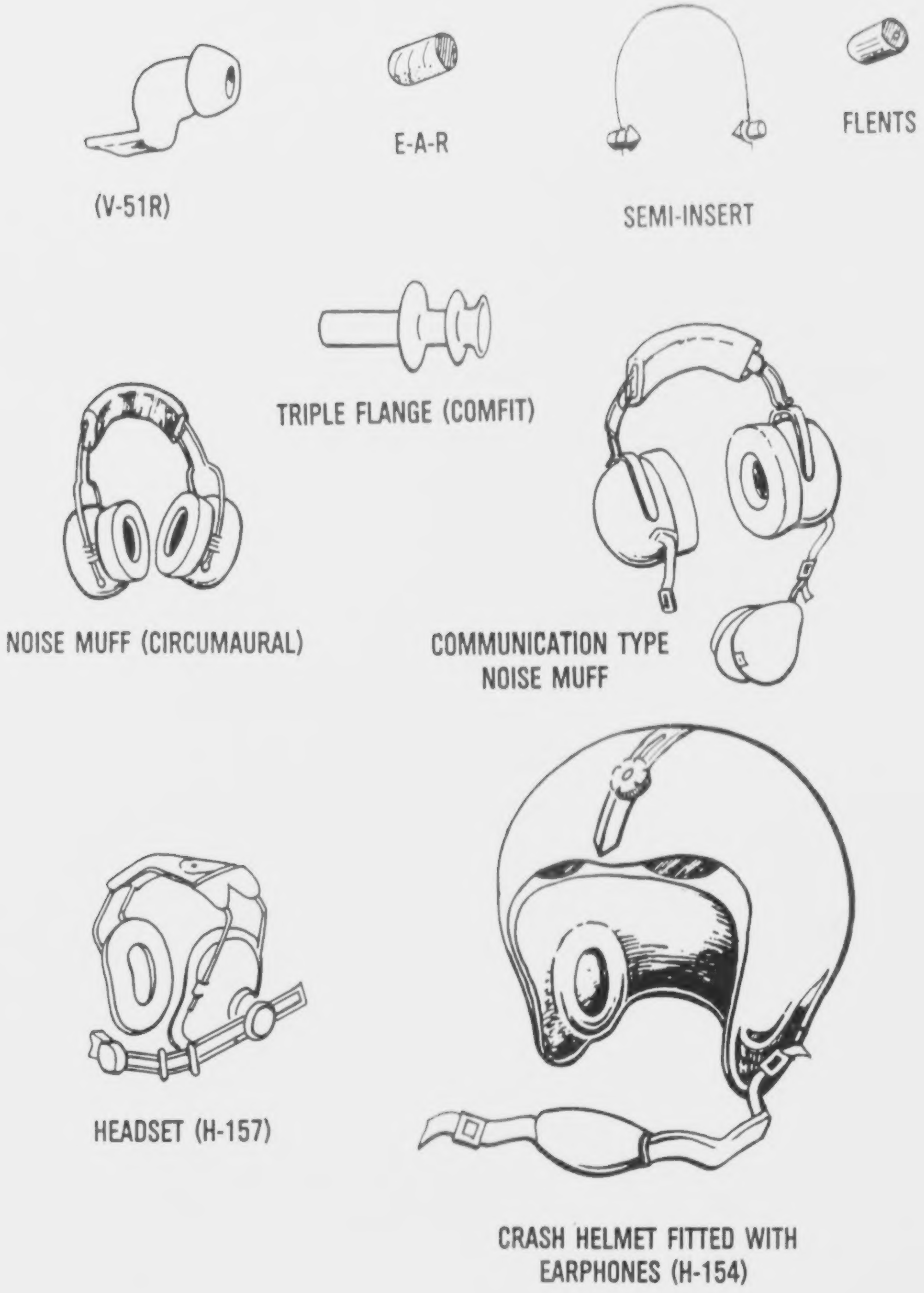


Figure 4–1. Types of ear protective devices.

Specifically, the devices referred to here encompass over-the-ear muffs which are worn only to reduce the undesirable effects of noise. An ear muff offers about the same amount of attenuation as a well-fitted earplug.

Exercises (218):

1. What causes auditory fatigue?

2. Why is it important that personnel wear earplugs even for off-duty exposures to high-noise levels?

3. How can people *improve* their ability to hear and understand speech in noisy environments by wearing ear protection?

4. What type of ear-protective device is similar to an earplug but does not insert into the ear canal?

219. State how ear-protective devices are fitted, cared for, and maintained.

Fitting Earplugs. Earplugs require careful fitting. Molded earplugs are designed to fit the majority of people who must wear them. Earplugs are designed to conform to anthropometric features of the external ear. You must individually check the size and anatomic orientation of each protector to ensure that adequate fitting is achieved. V–51R earplugs are molded in five sizes and about 98 percent of the males and 90 percent of the females in the Air Force can be adequately fitted with these devices. One out of four exposed employees, or 25 percent, may require a different size earplug for each ear.

The Sigma triple-flange plug was initially introduced with the claim that one size fits all. This claim has been proved false. The triple-flange is now produced in three sizes (small, regular, and large). No single sized earplug can be successfully fit to all exposed employees.

All insert earplugs require careful fitting. The plugs must be fitted individually. Once fitted, they must be checked to ensure that they are comfortable, properly sized, properly inserted and oriented in the external ear canal, and that behavioral attitudes relative to wearing the protectors are acceptable.

Care and Maintenance. Reusable ear-protection devices should be carefully cared for and kept clean. Earplugs should be washed in lukewarm water using hand soap, rinsed in clear water, and most important, thoroughly dried before the next use. Wet or damp earplugs should never be placed back into their container. If the earplugs are routinely used, they should be cleaned frequently. If not used daily, the earplugs should be cleaned after each use.

The cushions of ear muffs should also be kept clean. They can be cleaned in the same way as earplugs, but care should be taken not to wet the inside of the ear muff. If they should inadvertently get wet, the inside noise attenuating material should be taken out and allowed to completely dry before being reinserted and worn. When not in use, ear muffs should be placed in open air so that any moisture which may have been absorbed within the cups of the ear muff will evaporate. Persons who routinely wear ear-protection devices should be instructed to report to the medical service immediately if irritation or discomfort of the ear canals or head results from routine use of devices. The telephone number of the appropriate medical facility should be provided each exposed employee and his or her supervisor in order that they may obtain information or guidance if problems occur. Table 4-1 lists some of the positive and negative features of hearing protective devices.

Exercises (219):

1. Approximately what percentage of people will require different sizes of earplugs for each ear?

2. What are four things should you check to ensure that the earplugs have been fitted properly?

3. How should the earplugs be cleaned?

4. Describe the proper care of ear muffs.

4-3. Monitoring Noise Exposed Personnel

Noise-induced hearing losses can be prevented. The pure-tone hearing test identifies employees who demonstrate decreases in auditory sensitivity. The required annual hearing test is an extremely valuable tool in identifying the presence of a noise-induced hearing loss before it becomes severe.

The pure-tone hearing test is important because it reflects the status of the auditory system and can be used to measure the undesirable effects of noise. All military and civilian employees with other than an H–1 profile (table 4-2) are not allowed to enter into a career field where potentially hazardous noises are routinely encountered. Employees who repeatedly demonstrate a significant decrease in hearing sensitivity due to noise are recommended to be removed from any further exposures.

TABLE 4–1

POSITIVE AND NEGATIVE FEATURES OF HEARING PROTECTIVE DEVICES

TYPE	*POSITIVE*	*NEGATIVE*	*DURATION*
Insert			
V–51R Triple Flange	After adapation can be used for long periods. Relatively inexpensive.	Individual fitting by medical personnel required. Frequent fitting causes irritation.	Long-term (3–4 hours)
Headband Ear Caps			
Sound-Ban	Quickly fitted without touching ears. Easily carried.	Uncomfortable after 1 hour. Very variable in protection.	Short-term Frequently off/on.
Disposable			
EAR Deci-Damp	Comfortable. Individual fitting not required. Relatively inexpensive.	Molded by hand. Easily soiled. Difficult to clean.	Infrequent use. Transitory noise exposure.
Circumaural Muffs			
Type I and II 372–9 AN/2	May be worn over plugs. Most efficient universal device.	Expensive. Heavy. Difficult to carry. Hair or eyeglasses may reduce effectiveness.	Long- or short term.

One single type of hearing protective device will not meet the needs of all personnel in a hearing conservation program. The appropriate type of hearing protective device should be selected based upon a consideration of the factors listed above and the employee's desire . . . in addition to the degree of attenuation required in a particular situation. AFR 161–35 (Table 3) gives the amount of attenuation that may be assumed for different ear protectors.

TABLE 4-2

USAF MEDICAL PROFILES FOR HEARING

H-1	The audiometric threshold for each of the frequencies of 500, 1000, and 2000 Hz must not exceed 25 dB. In addition, the total or sum of the audiometric threshold at the frequencies of 3000, 4000, and 6000 Hz for both ears must not exceed a total of 270 dB.
H-2	Audiometric thresholds for the frequencies of 500, 1000, or 2000 Hz must be equal to but not exceed the following:

	500 Hz	*1000 Hz*	*2000 Hz*
Best Ear	30 dB	30 dB	30 dB
Worse Ear	30 dB	50 dB	50 dB

H-3	Any hearing loss greater than H-2. The patient's remaining auditory acuity, unaided or aided, must permit the reasonable fulfillment of the purpose of the individual's employment on active duty in some occupational capacity commensurate with his or her grade.
H-4	Any hearing loss with which, despite the maximum benefit from a hearing aid, the active duty member is unable to perform the duties of his or her office, grade, or rank in such a manner as to reasonably fullfill the purpose of the member's employment.

The Air Force first incorporated a comprehensive hearing conservation program in October 1956. A revised program was introduced on 27 July 1973 and again in April 1982 with the publication of AFR 161-35, *Hazardous Noise Exposure*. All military, civilian, ANG, and AFRES personnel are included in this program. Monitoring audiometry is an essential part of this program. Monitoring audiometry is mandatory for all personnel exposed to the equivalent of 84 dBA for 8 hours per day and may be required for anyone exposed to the equivalent of 84 dBA for 8 hours per week. The actual measurement of the noise level present in the employees workplace is the responsibility of the BEE. When they encounter hazardous noise levels they try to use engineering controls (i.e., isolation of the noise source with an acoustical cover) to eliminate the hazard. Sometimes this is not possible, and in the interim, until the problem can be corrected, the workers' hearing must be protected. Your responsibility is to manage and monitor the overall effectiveness of the USAF hearing conservation program at your base, thereby protecting the employees' hearing.

220. State environmental health responsibilities for hearing conservation.

Monitoring Audiometric Examinations. You should compare annual test results with the reference audiometric examination; monitor the 15- and 40-hour noise free followup audiometric examination; monitor the recommendations on patients referred to USAF hearing conservation diagnostic centers or audiologist; and initiate a physical profile change if needed. Also you need to monitor "no show" rates (those who failed to show up for the audiometric examination).

Maintaining Computer Lists. One of the facets of monitoring this program entails inputting, deleting, and updating computer products of personnel on the hearing conservation program. The computer code for a hearing test is M for active duty personnel. For civilians, code T requires an annual physical and hearing test. Some of the computer products you will be working with are:

- The quarterly verification roster with statistical summary.
- Newcomers roster (monthly).
- Monthly hearing test appointment product.
- "No show" monthly product.
- Monthly occupational health education product.

Refer to Chapter 2, Standardized Occupational Health Program, if you need to review the procedures for inputting, deleting, and updating computer lists.

Fitting Earplugs. You will issue earplugs and instruct noise exposed personnel on the use of the protective device and when it needs to be worn.

Educating Noise-Exposed Employees. You will educate noise-exposed personnel on the adverse effects of hazardous noise and proper use and care of ear-protective devices. Document this training and earplug fitting on the AF Form 2767. This form is used to document the issuing of both respiratory and hearing conservation safety equipment (respirators and earplugs and/or ear muffs) and the training related to these two areas. After documentation make sure it is filed in Tab F of the industrial case files. (See AFOSH Standard 161-17, *Standardized Occupational Health Program*.)

Monitoring of Workplace. You should ensure that appropriate safety personnel routinely visit all hazardous workplaces and cite all exposed employees and supervisors who are not complying with safety requirements. As stated previously, the workplace is also a good place to re-enforce how effective ear-protective devices are and how they help workers do a better job (i.e., by improved communication).

Exercises (220):

1. How do you update the computer listing of active duty personnel who have had recent audiograms?

2. How do you monitor the audiometric test forms?

3. When educating the noise-exposed person, what should your briefing include?

4. Why visit the workplace to observe exposed employees?

4-4. Disposition of Noise Exposed Personnel

This section provides "desk reference" type summaries of procedures specified in AFR 161–35 for the disposition of USAF personnel who are considered to be occupationally exposed to potentially hazardous noise. Included are: (1) an outline of hearing conservation hearing test forms, (2) a listing of the various numbers needed to determine whether or not a significant threshold shift has occurred, and (3) a disposition flow chart. These summaries are specifically intended as supplement; not as replacement—for the guidance outlined in AFR 161–35.

221. Specify appropriate disposition for noise exposed personnel.

Hearing Conservation Tests. Table 4-3 states the requirements and reasons for the various types of hearing tests. Study this table. It will aid you in monitoring the disposition of those exposed to hazardous noise.

Significant Threshold Shift (STS). Refer to table 4-4 for a listing of significant threshold shifts. In managing the hearing conservation program you must ensure that patients who may have problems with their hearing receive proper followup examinations. Determining if there is a significant threshold shift is the first step.

Disposition Flow Chart. The disposition flow chart (fig. 4-2) shows the sequence of most hearing tests included in the USAF Hearing Conservation Program. Following the chart is very simple. An oval represents an entry or exit point, a rectangle is something that is done (usually hearing test), and a diamond is a decision point. The decision is nearly always a simple matter of answering "yes" or "no" to the question of whether or not a significant threshold shift has occurred. The flow always follows the direction shown by the arrows.

The flow chart is not intended to stand alone. Serious errors may result when the user, if not fully cognizant of the procedures that must be accomplished between segments, fails to do certain things. For example, a person demonstrated significant threshold shifts on an annual examination and the shift persisted on the 15-hour noise-free followup examination. Before the next step on the flow chart is taken (the 40-hour), the individual should be referred to the attending physician to determine any apparent cause. If no apparent cause is found, the next step is to administer the 40-hour noise-free examination. If an apparent cause of the hearing loss is medically correctable, the 40-hour noise-free examination is accomplished after proper medical treatment but before further hazardous noise is encountered.

Exercises (221):

1. What is a significant threshold shift on a 90-day followup or annual hearing test?

2. If there was an STS on a 40-hour noise-free hearing test, what should be done?

3. Below what noise level should a person be in order to be considered as noise-free?

4. Why do you administer detailed followup (DFU) examinations to a patient who continues to manifest an STS?

5. If there is an STS on any of the detailed followup hearing test, what should be done?

6. If hearing sensitivity improves by 20 dB or more at two or more frequencies on any of the followup hearing tests what should you do?

7. State the reasons why close scrutiny audiometric tests are sometimes recommended.

TABLE 4–3

TYPES OF HEARING CONSERVATION TESTS

The following examinations are administered to active duty Air Force, Civilian, Air National Guard, and Air Force Reserve personnel who are exposed to hazardous levels of noise.

I. *DD Form 2215 - REFERENCE AUDIOGRAM*

Why - To provide an audiometric reference in order to compare future hearing tests.

When - Within 30 days of finding that the person is working in potentially hazardous noise.

Special Requirements -

(1) Person must have been "noise free" (below 75 dBA) for at least 48 hours prior to the hearing test.
(2) H–1 physical profile must be met to be eligible to be employed in a noise hazardous area. (Civilian or military).

Disposition - Meets H–1 - Begins duties and schedule for 90-day followup.
Fails H–1 - Reject from duties in noise or refer to Hearing Conservation Diagnostic Center (HCDC).

II. *DD Form 2216 - HEARING CONSERVATION DATA*

A. 90-Day Followup Examination.

Why - To identify persons who are highly sensitive to noise.

When - 90–120 days after beginning duties in noise.

Disposition - No STS - Schedule an annual hearing test.
STS - Schedule a 15-hour noise-free hearing test.

B. Annual Hearing Test.

Why - To check for noise-induced hearing loss.

When - One year after 90-day, last annual, or last special test.

Disposition - No STS - Continue annual evaluations.
STS - Schedule a 15-hour noise-free hearing test.

C. 15-Hour Noise-Free Hearing Test.

Why - to recheck hearing levels when STS is found on 90-day close scrutiny or annual audio, check hearing protection, and to provide education.

When - After a minimum of 15 hours of auditory rest.

Disposition - No STS - Refit ear protectors, education, return to duty, annual check.
STS - 40-hour noise-free hearing test.

D. 40-Hour Noise-Free Examination

Why - To recheck hearing levels (second recheck) when STS is found on 15-hour noise-free examination.

When - After examination and clearance by the physician and after a minimum of 40 hours of auditory rest.

Disposition - No STS - Refit ear protectors, educate, return to duty, annual check.
STS - Choose One:
(a) Referral to a USAF hearing conservation diagnostic center.
(b) Detailed Followup.
(c) Referral to the base audiologist.

TABLE 4–3 (contd.)

E. Detailed Followup #1.

Why - To determine if the hearing loss continues to increase over time.

When - Three months after the 40-hour noise-free examination.

Disposition - No STS - Detailed followup #2
STS - Refer to a USAF Hearing Conservation Diagnostic Center.

F. Detailed Followup #2.

Why - To determine if the hearing loss continues to increase over time.

When - Three months after detailed followup #1.

Disposition - No STS - Resume annual monitoring by establishing the 40-hour noise-free examination as the new reference.
STS - Refer to USAF Hearing Conservation Diagnostic Center.

G. Close Scrutiny Audiometric Tests (stringent medical monitoring).

Why - To check for hearing loss when unusual circumstances exist:
(1) When personnel are employed in extreme noise areas.
(2) When noise levels are unknown.
(3) When personnel cannot be adequately protected due to anthropometric or medical reasons.

When - At intervals specified by the USAF HCDC, base audiologist, or physican (weekly, monthly, quarterly, etc.).

Disposition - No STS - Continue schedule.
STS - Schedule 15-hour noise-free followup.

H. Termination Hearing Test.

Why - To document hearing levels at the end of employment.

When - Within 90 days of termination and after a 40-hour noise-free period.

Disposition - Enter audiometric test results on DD Form 2216. If any hearing problems are noted, refer to USAF HCDC.

TABLE 4–4

SIGNIFICANT THRESHOLD SHIFTS (STS)

For 90-Day, annual, 15-hour, and 40-hour audios:
20 dB or more at the frequencies of 1000, 2000, 3000, 4000 Hz, either ear, is considered significant.

For Detailed Followup Examinations:
15 dB or more at the frequencies of 1000, 2000, 3000, 4000 Hz, either ear is considered significant.

IMPROVED HEARING

For any followup hearing test - if hearing improves by 20 dB or more at 2 or more frequencies, the reference examination should be reestablished.

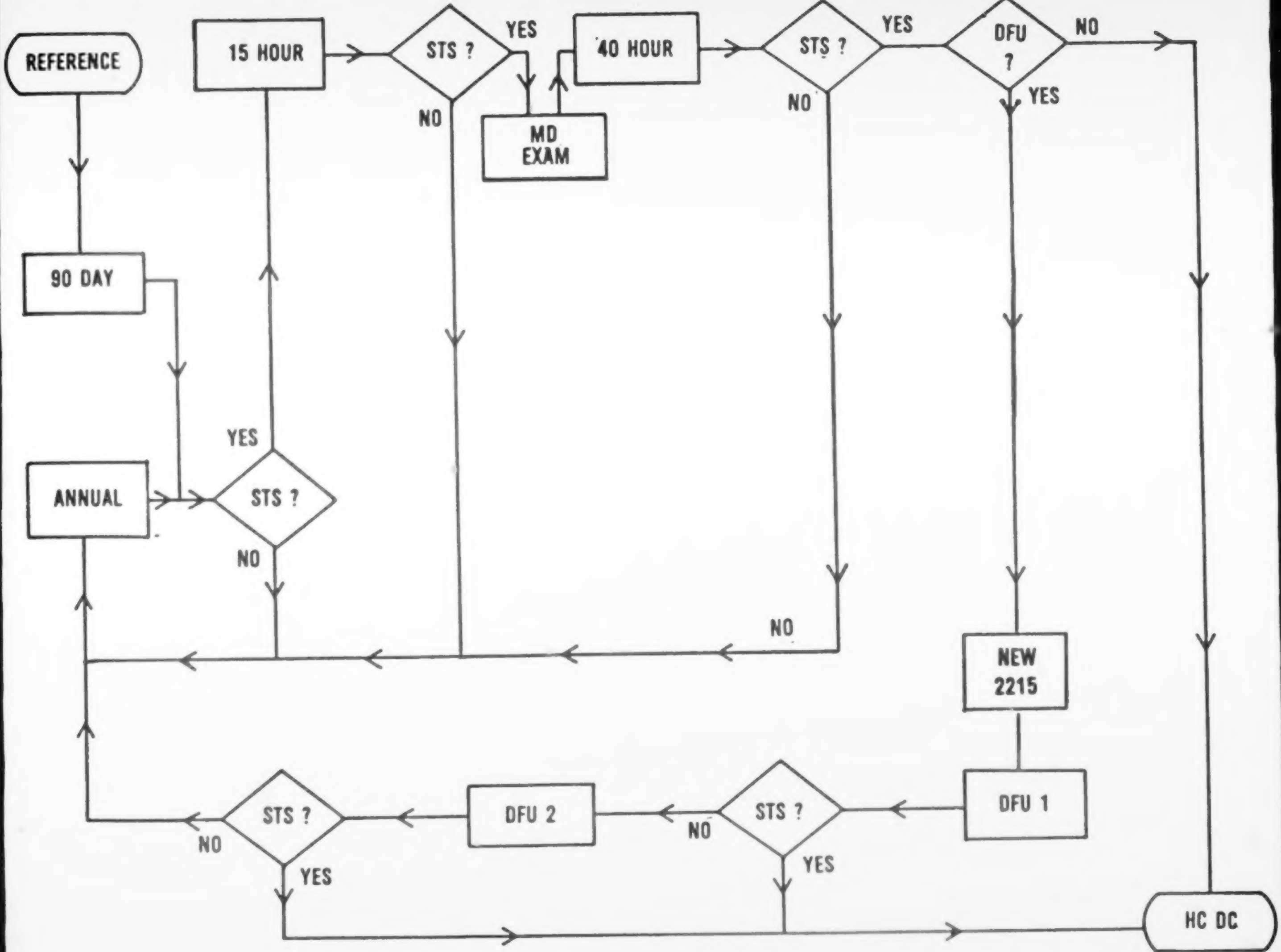


Figure 4–2. Hearing conservation patient disposition flow chart.

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AFR 161–35, *Hazardous Noise Exposure*
AFOSH STD 127–31, *Personal Protective Clothing and Equipment*
AFOSH STD 127–66, *General Industrial Operations*
AFOSH STD 161–1, *Respiratory Protection Program*
AFOSH STD 161–8, *Permissible Exposure Limits for Chemical Substances*
AFOSH STD 161–17, *Standardized Occupational Health Program*

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Glossary

Abate—To eliminate or reduce permanently an unsafe or unhealthful working condition by coming into compliance with the applicable AFOSH, EPA, OSHA, or other standard.

ACGIH—American Conference of Governmental Industrial Hygienists.

Action Level—A time weighted average concentration of which occupationally exposed individuals will start receiving occupational health physicals, unless otherwise specified in an AFOSH Standard (one-half the relevant PEL, TLV, etc.).

Administrative Control—*Any procedure that limits daily* exposures to toxic chemicals or harmful physical agents by controls other than engineering controls (i.e., rotation of workers, work practice control, monitoring, etc.)

ANSI—American National Standards Institute, a national consensus standard-developing organization.

Audiogram—A graph or table showing hearing threshold levels as a function of frequency.

Audiometer—Instrument used to measure hearing sensitivity using pure tones.

A-Weighted-Sound Level (dBA)—Sound level in decibels as measured on a sound level meter using an A-weighted network. This network attempts to reflect the human ear's decreased sensitivity to low-frequency sounds.

Capture Velocity—That velocity at any distance in front of a hood necessary to overcome opposing air currents and to capture the contaminated air by causing it to flow into the exhaust hood.

Ceiling Value—An exposure which cannot be exceeded for any length of time.

Chronic—Persistent, prolonged, repeated.

Concentration—The quantity of a substance per unit volume. Examples are: mg/m^3 (milligrams per cubic meter) for vapors, gases, fumes, or dusts; ppm (parts per million) for vapors or gases; and fibers/cc (fibers per cubic centimeter) for asbestos.

Decibel-dB—A unit used to express sound pressure levels. In hearing testing, the unit used to express hearing threshold levels is referred to audiometric zero (re: ANSI S3.6, 1969).

A Disabling Work/Duty Injury—Any impairment resulting from an accident or occupational disease that prevents a military person from performing his or her regularly established duty or work for a period of 24 hours or more, or prevents a civilian employee of the Air Force from performing work for a full shift on a day subsequent to the day of injury.

Dosimeter—An instrument used for measuring cumulatively the exposure (to radiation, noise, etc.) of an individual over a period of time.

Effectiveness of Corrective Action—The degree to which the proposed hazard abatement system can be expected to reduce the cited hazard. For health hazards, this would typically be expressed as the intensity of the hazardous chemical or physical agent remaining, in appropriate units, after the proposed abatement measure is operational. For safety hazards, effectiveness is expressed as "in full compliance" or "not in full compliance" with the applicable standard, if any.

First Aid—Any one-time treatment, any followup visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care. Such one-time treatment, and followup visit for the purpose of observation, is considered first aid even though provided by a physician or registered professional personnel.

Frequency—The rate at which a sound source vibrates or makes the air vibrate. The unit of time is usually 1 second and the term Hertz (Hz) is used to designate the number of cycles per second. Frequency is related to the subjective sensation of pitch. High-frequency sounds (2000, 3000, and 4000 Hz) are high pitched.

Fume—Very small (10 micrometers or less) solid particles formed by condensation of volatized solids, usually metals.

Hazard—A workplace condition that might result in injury, health impairment, illness, disease, or death to any worker and could identify a condition that could result in property/equipment damage or loss.

Hazardous Material—For the purpose of reviewing the material safety data sheet, a hazardous material is defined as a material having one or more of the following characteristics: (a) has a flashpoint below 200 °F (93.3 °C), subject to spontaneous heating, or is subject to polymerization with release of large amounts of energy when handled, stored, and shipped without adequate control; (b) has a threshold limit value below 1000 ppm for gases and vapors, below 500 mg/m^3 for fumes, and below 30 mppcf for dusts; (c) a single oral dose which will cause 50 percent fatalities to test animals when administered in doses of less than 500 mg per kilogram of test animal weight; (d) is a strong oxidizing or reducing agent; (e) causes first degree burns to skin in short-time exposure, or is systemically toxic by skin contact; (f) in the course of normal operations, may produce dusts, gases, fumes, vapors, mists, or smokes with one or more of the above characteristics; (g) produces sensitizing or irritating effects; (h) is radioactive; or (i) the item has special characteristics which, in the opinion of the manufacturer, could cause harm to personnel if used or stored improperly.

Hazardous Material Information System (HMIS)—A computer-based information system developed to accumulate, maintain, and disseminate important characteristics of hazardous materials which exist throughout the DOD.

IDLH—Immediately Dangerous to Life and Health: An atmosphere that poses an immediate hazard to life or produces immediate irreversible debilitating effects on health.

Illness—Any abnormal condition or disorder, other than one resulting from an injury, caused by exposure to conditions associated with the occupational environment.

Imminent Danger—A condition that immediately threatens the loss of life or serious injury or illness of an employee.

Impulse or Impact Noise—Sound of short duration, usually less than 1 second, with an abrupt onset and rapid decay.

Material Safety Data Sheet (MSDS)—The form (OSHA Form 20 or equivalent) used to display important characteristics of a particular hazardous material.

Mist—Finely divided liquid droplets suspended in air and generated by condensation or by atomizing, splashing, and foaming of liquids.

Monitoring (Industrial Hygiene)—Measurement of the amount of contaminant or physical stress reaching the worker in the environment.

Monitoring (Medical Surveillance)—The preplacement and periodic evaluation of the health status of workers exposed to toxic substances or physical agents in the workplace; measures the effects of contaminant on workers' body function and tissues (e.g., decreased lung function, dermatitis, abnormal blood count).

Monitoring (Hearing Tests)—Periodic hearing tests, obtained subsequent to the reference hearing test, which are used to detect shifts in the individual's threshold of hearing.

Noise Exposure—Personal interaction to a combination of sound level and its duration.

Occupational Health—That multidisciplinary field of general preventive medicine that is concerned with the prevention and/or treatment of illness induced by factors in the workplace environment.

OSHA—Occupational Safety and Health Administration, Department of Labor.

OSHAct—The Williams-Steiger Occupational Safety and Health Act of 1970.

OSHA Standards—OSHA Standards are those standards issued by the Department of Labor's Occupational Safety and Health Administration pursuant to Section 6 of the OSHAct. Air Force Occupational Safety and Health (AFOSH) Standards are occupational safety and health standards published by the Air Force, which include, are in addition to, or are alternatives for, the OSHA Standards which prescribe conditions and methods necessary to provide a safe and healthful working environment.

PEL—Permissible Exposure Limit. Airborne concentrations of substances that represent conditions *under* which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.

Potentially Hazardous Noise—Exposure to greater than 84 dBA sound level or 140 dB peak sound pressure level for impact or impulse noise.

Potentially Hazardous Noise Area—Any work area where the A-weighted sound level (continuous or intermittent) is greater than 84 dB; any work area where the peak sound pressure level (impulse or impact noise) exceeds 140 dB.

Protective Equipment—A device or item to be worn, used, or put in place for the safety or protection of an individual or the public at large when performing work assignments in or entering hazardous areas or under hazardous conditions. Equipment includes hearing protection, respirators, safety goggles, face shields, safety shoes, gloves, aprons, etc.

Pure-Tone Audiogram—A set of measures that compares the hearing sensitivity of an individual in detecting faint pure tones in a quiet test room to the corresponding ability in a normal hearing young adult population.

Reference Hearing Test—A base line hearing test that is used as a reference in computing any possible future threshold shift. Normally, this reference audiogram will be the first performed for hearing conservation purposes.

Risk Assessment Codes (RAC)—A simple expression of risk which combines the elements of hazard severity and mishap probability.

Serious Physical Harm—Permanent, prolonged, or temporary impairment of the body in which part of the body is made functionally useless or is substantially reduced in efficiency on or off the job.

Smoke—Carbon or soot particles less than 0.1 micrometer in size resulting from the incomplete combustion of carbonaceous materials such as coal or oil.

Standard—A rule, established by competent authority, which designates safe and healthful conditions or practices under which work can be performed without injury, occupational illness, or property damage.

TLV—Threshold Limit Value. Values established by the American Conference of Governmental Industrial Hygienists (ACGIH). TLVs refer to airborne concentrations of a substance and represent conditions under which it is believed that nearly all workers may be exposed day after day without adverse effect.

Toxic Substance or Harmful Physical Agent—Any chemical substance, biological agent (bacteria, virus, fungus, etc.), or physical stress (noise, heat, cold, vibration, repetitive motion, ionizing and nonionizing radiation, hypo-hyperbaric pressure, etc.), which: is regulated by an AFOSH Standard or Federal law or rule due to a hazard to health; is listed in the latest printed edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemicals.

TWA—Time-Weighted Average. An average value weighted in terms of the actual time that it exists during a given time interval.

APPENDIXES

Appendix A. Occupational Health Education Programs

Appendix B. Hearing Protective Devices

APPENDIX A

OCCUPATIONAL HEALTH EDUCATION PROGRAMS

SUBJECT	*PROGRAM NUMBER*
RESPIRATORY PROTECTION PROGRAM	52402 ST35-K
HEARING CONSERVATION	52334-DF
ISOCYANATES	600262-DF
FIREFIGHTING - MINIMIZING RISKS	600269-DF
HEALTH RISKS OF SOLVENTS AND DEGREASERS	602410-DF
IONIZING RADIATION	600296-DF
RADIOFREQUENCY RADIATION HAZARDS	52736 NP16-16 MM FILM (18 MIN 5 SEC)
F-16 HYDRAZINE HAZARD EMERGENCY SPILL PROCEDURES	50382 ST35-K
HEALTH RISKS OF FUEL TANK ENTRY	UNDER FINAL REVIEW
HEALTH RISKS OF ELECTROPLATING	
HEALTH RISKS OF ASBESTOS	UNDER FINAL REVIEW
HEALTH RISKS OF PCB'S	"
WASTE ANESTHETIC GASES: RISKS AND CONTROL	"
PESTICIDE HANDLING	IN DEVELOPMENT
PREGNANCY IN THE WORK ENVIRONMENT	"
HEALTH RISKS IN THE HOSPITAL INDUSTRIAL COMPLEX	"
HEALTH RISKS OF LEAD	"
PREVENTIVE MEDICINE FOR MOBILE TEAMS (PRIME BEEF)	"
HEALTH RISKS OF FUELS AND OTHER PETROLEUM PRODUCTS	"
HEALTH RISKS IN CORROSION CONTROL	"
HEAT STRESS	"
HEALTH RISKS OF MERCURY	"
USAF PLAGUE CONTROL PROGRAM	"

APPENDIX B

HEARING PROTECTIVE DEVICES

	Manufacturers Nomenclature/NSN	*Type of Protector*	*Federal Nomenclature*
1.	Ear Defender V-51R 6515-00-442-4765	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (X-Small) (White)
2.	Ear Defender V-51R 6515-00-467-0085	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Small) (Green)
3.	Ear Defender V-51R 6515-00-467-0089	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Medium) (Intl. Orange)
4.	Ear Defender V-51R 6515-00-442-4807	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Large) (Blue)
5.	Ear Defender V-51R 6515-00-442-4813	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (X-Large) (Red)
6.	Comfit, Triple Flange 6515-00-442-4821	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Small) (Green)
7.	Comfit, Triple Flange 6515-00-442-4818	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Medium) (Intl. Orange)
8.	Comfit, Triple Flange 6515-00-467-0092	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Large) (Blue)
9.	EAR or Deci-Damp 6515-00-137-6345	Foam Plastic Insert	Plug, Ear, Hearing Protection (Universal Size) (Yellow, 200 pr)
10.	Flents 6515-00-721-9092	Wax Impregnated Insert	Flents, Wax, Impregnanted, Disposable
11.	Propp-O-Plast 6515-01-071-2515	Disposable Insert	Propp-O-Plast, U.S. Mil. Configuration, Disposable Insert
12.	Headband, Universal Size 6515-00-392-0726 (Sound-Ban Type)	Headband, Earcaps	Plug, Ear, Hearing Protection (Universal Size)
	6515-00-181-8058 (Sound Sentry Type)		
13.	Ear Plug Cases 6515-00-299-8287	Plastic Type	Case, Earplug 12's
14.	Circumaural Muff		
	4240-00-691-5617 (Type I)	Overhead Headband	Aural Protector, Sound
	4240-00-022-2946 (Type II)	Rotating Headband	Aural Protector, Sound
15.	Associated Equipment		
	Replacement Filter, dome 4240-00-674-5379		
	Replacement Seal, dome 4240-00-979-4040		
	Pad, Protective Ear Piece 6540-01-094-8292		

Answers for Exercises

CHAPTER 1

References:

200 – 1. The physical hazard may produce damage to the health and may cause traumatic injury to occur as a result of the exposure to the agent.
200 – 2. Temporary and permanent threshold shifts.
200 – 3. Vibration.
200 – 4. Damage to the eye and its ability to function; damage to the reproductive system; and burns of the skin.
200 – 5. Harmful carcinogenic and genetic effects; may also affect offspring.
200 – 6. Age, surface area to weight ratio, and the acclimation of the individual exposed.
200 – 7. Perspiration and dilation and constriction of the blood vessels.
200 – 8. Immunization and educating them concerning the importance of maintaining good health so that their body's defense system can function at peak efficiency.
200 – 9. Type of substance; route of entry; amount of exposure; duration of exposure; and physiological differences of the individual.
200 – 10. LD_{50} - dose of an agent which will produce death in 50 percent of the dosed animals; LC_{50} - concentration in air that will produce death in 50 percent of the animals exposed.
200 – 11. Skin.
200 – 12. Deprive the cells of their oxygen supply.
200 – 13. Acetylene hydrocarbons, ethyl ether, paraffin hydrocarbons, and aliphatic ketones; depress the central nervous system.
200 – 14. Agents that damage the nervous system.
200 – 15. Gases and vapors, particulate matter, liquids, and solids.

201 – 1. Cause central nervous system depression, defatting of skin, and liver and kidney damage.
201 – 2. Asphyxiation and CNS depression; acetylene, gasoline, kerosene, and stoddard solvent.
201 – 3. Inhalation and skin absorption.
201 – 4. Exposure to fuels and dermatitis-producing agents; explosion; fire; and confined space entries.
201 – 5. Dermatitis; inhalation hazards (isocynates); CNS depression; liver and kidney damage; and eye irritation.
201 – 6. Lab - acids, infectious material, and xylene; dental clinic - acids, ammonia, mercury, and radiation (x-ray); Medical maintenance - degreasing solvents, mercury, welding, and X-ray radiation; medical X-ray - developers and X-ray; surgery - anesthetic gases, radiation; hospital civil engineering - solvents, gases, noise, heat, and paints.

202 – 1. By using a less hazardous or toxic material, process, or equipment to control the hazard.
202 – 2. Separate the source from the work area; enclose or shield the source with physical barriers; automate the process; and remove and store the toxic materials in another location, away from the workers.
202 – 3. Training of workers; monitoring the work area or the worker; scheduling workers into the area; and preventive maintenance scheduling to assure the proper functioning of existing controls.
202 – 4. Workers can be trained to identify hazards and report them before an accident occurs. You can also use training to provide workers with methods and procedures to avoid hazards.
202 – 5. It is only to be used as a last resort and a temporary measure until permanent controls can be installed.
202 – 6. (1) They don't know it's available; (2) it doesn't provide proper protection; (3) it's uncomfortable; (4) it's not maintained, and (5) the workers don't realize the need for it.

203 – 1. (1) Ensures appropriate evaluation and follow-up on occupational illnesses and injuries; (2) establishes a data repository; (3) standardizes data gathering; and (4) establishes a system for obtaining information on these occurrences from the field.
203 – 2. An occupational injury is a cut, fracture, sprain, etc., from an exposure involving a work environment. An occupational illness is a condition or disorder resulting from environmental factors associated with employment.
203 – 3. Injury.
203 – 4. Illness.
203 – 5. Description of incident or exposure and information on toxic chemicals or physical agents involved.
203 – 6. Patient's medical record.
203 – 7. Health care provider; your files. If it is an injury then a copy is sent to Ground Safety; if an illness to resource management office.

204 – 1. Little effect at Air Force exposure levels; if the exposure levels are safe for mother then they should be safe for her unborn child.
204 – 2. Less than 500 milirem/year.
204 – 3. The infectious organism may cross the placental barrier and cause harm. Additionally, the condition caused by the infectious organism may have to be treated with drugs which may in themselves cause adverse side effects.
204 – 4. Use properly designed low-leak anesthesia equipment attached to gas scavenging system.
204 – 5. May cause abnormalities and is capable of causing damage to the nervous system, kidneys, and blood-forming organs.
204 – 6. Through her milk in breast feeding the infant.

205 – 1. Health care provider.
205 – 2. Must inform workers of potential hazards in the workplace.
205 – 3. Determine actual duties; get a medical history and a social history (smokes, alcohol use, hobbies, etc.); discuss the hazards and chemicals in the work environment; recommend restrictions.
205 – 4. No fluoroscopy work; flying duties; or duties with waste anesthetic gases (for first 4 months); no work in areas when the ceiling level of a PEL can't be controlled.
205 – 5. Read the case file of the shop and if more information is needed, forward a copy of the SF 513 to the BEE to have the industrial shop evaluated.

206 – 1. To reduce the incidence of repeated job-related accidents.
206 – 2. Five years; Tab F of the case file.
206 – 3. a. An indepth examination of management's responsibilities for OSH programs.
  b. Compliance with procedures for accident/injury reporting procedures and how inspections/investigations of these incidents are conducted.
  c. A review of AF policy on all relevant aspects of the AFOSH program.
206 – 4. How to recognize unsafe/unhealthy working conditions, enforcement of AFOSH standards and accident investigation procedures, and the use and maintenance of personal protective equipment.
206 – 5. a. Command and/or local policy on occupational health education.
  b. Work unit policy on occupational health and education.
  c. Worker's own responsibility for safety and health; reporting procedures for hazardous operations/conditions.
  d. Awareness of hazards in areas with electrical hazards, hazardous materials, etc., which could result in loss of heart/lung function.
206 – 6. Reference library, audiovisual library, other health services (NIOSH, OSHA, USPHS, etc), HMIS system, and various periodicals (*Navy Lifeline*, etc.).
206 – 7. A system designed to acquire, store, and disseminate data on hazardous materials at your bases.

CHAPTER 2

207 – 1. Record why that exposure can't be monitored by medical tests in the industrial case file for that shop.
207 – 2. a. Personnel are being protected from exposures exceeding the PEL's by respirators.
  b. Personnel are being exposed to levels exceeding one-half of the TWA, or potential for skin absorption exists.
  c. Personnel show signs or symptoms that could be attributed to the types of exposures involved.

d. Personnel are exposed to levels above the PEL or have had skin contact with agents during emergencies or accidents.

207 – 3. These tests should be biological indicators of the occupational exposure, and only those diagnostic tests or clinical examinations which would detect changes in the target organ of the chemical exposure should be included in occupational physicals.

207 – 4. AFR 161–33, AFR 168–4, and AFR 12–50.

208 – 1. Short-term (acute) illnesses can cause losses in manpower, thereby affecting productivity, and long-term (chronic) exposures can cause losses in experienced and trained personnel as well as losses due to compensation claims.

208 – 2. Unhealthy work environments can have a damaging effect on the health of the worker. This can cause a loss of efficiency in being able to operate and maintain high-performance aircraft and sophisticated missile systems.

208 – 3. The prevention of disease and injury and the promotion of worker health.

209 – 1. To identify and evaluate environmental stresses so that they can be controlled.

209 – 2. A detailed assessment of the operations performed, including the specific risks, available control measures, and the effectiveness of such measures.

209 – 3. To determine the adequacy of actions taken to correct any unhealthy working conditions detected at the time of the base line survey; to check the continuing effectiveness of, and need for, other control measures; and to evaluate any new or changing processes.

209 – 4. A medical practitioner, supervisor, employee representative or employee, or you.

209 – 5. Recognition, evaluation, and control.

209 – 6. An evaluation of work practices is made (i.e., the wear and maintenance of protective equipment, sanitation of latrines and break areas, etc.).

209 – 7. AF Form 2767.

209 – 8. AF Form 2755.

210 – 1. Tab B.

210 – 2. To record brief information regarding actions involving surveillance of the workplace (i.e., entries of base line, annual, or special surveys; telephone conversations; and informal visits); in Tab A.

210 – 3. Tab E.

210 – 4. SF 513, AF Forms 190; occupational verification rosters, and AF Forms 2766 and 2767.

210 – 5. The public has access to only two forms - the AF Form 2766 and 2767.

211 – 1. Tests and examinations done to establish whether the worker is physically capable of doing his or her job as well as to document base line data for the evaluation of future potential exposures.

211 – 2. To evaluate and document the health effects of occupational exposures.

211 – 3. By FAC, OSC, or AFSC.

211 – 4. Aerospace Medicine Council.

211 – 5. By contacting the shop supervisor to find out what each worker actually does. Then these individuals will need to be coded separately so that actual occupational exposures can be monitored accurately.

211 – 6. Name, rank, SSAN, FAC/OSC, AFSC, date of birth (DOB), date of assignment (DAS), date eligible for return from overseas (DEROS), and all clinical examination codes and dates of examinations in the computer system.

211 – 7. Your updated copy of the master personnel roster.

211 – 8. In Tab F of the appropriate case file.

211 – 9. Draw a line through the entire line on that person on the occupational verification roster and write (in bold letters) DELETE and the reason why (e.g., PCS) beside this line.

211 – 10. For scheduling base line physicals and to help you keep the system current.

211 – 11. The occupational verification roster lists the date of last examination and the monthly occupational exam roster has a blank for the entry of the current examination date.

211 – 12. The occupational verification roster may be used to verify attendance at your health education briefings; the newcomer's roster may be used to ensure attendance at initial briefings for all incoming personnel and to develop a roster for the hospital employee health program.

212 – 1. At least annually; AF Form 2754.

212 – 2. Notify the BEE so that they can investigate work practices or other causes.

212 – 3. Verifying workers against designated workplaces and the types and dates of last examinations.

212 – 4. At least annually.

CHAPTER 3

213 – 1. (1) False. Air purifying respirators only remove any contaminants from the air that is being inhaled. Sufficient oxygen must be present.

(2) True.

(3) False. These respirators should be used only for nonemergency (or non-IDLH) situations.

(4) False. The efficiency is increased; however, resistance to breathing is also increased.

(5) False. It must be located in an uncontaminated area since it supplies breathing air to the worker.

(6) True.

(7) True.

214 – 1. Initial use and supervisory training.

214 – 2. An explanation of the nature, effects, and extent of the respiratory hazards to which the worker may be exposed.

214 – 3. Realistic test atmosphere.

214 – 4. In the development of their in-house respiratory protection programs.

215 – 1. Cardiovascular impairments.

215 – 2. Lung - asthma, emphysema, difficulty in breathing, previously documented lung problems; heart - high blood pressure, artery disease, documented heart problems; other - facial scars, claustrophobia, etc.

215 – 3. User's name; date and type of training; type, manufacturer, model number and size of respirator; medical representative and the medical facility.

215 – 4. AF Form 2767.

215 – 5. Individual designated by supervisor for issuance.

215 – 6. Emergency-use respirators.

215 – 7. BES.

215 – 8. To assure that respiratory protective devices are used and maintained properly and that in-house records are adequate.

215 – 9. EHS.

215 – 10. Required use in IDLH, confined spaces, low temperatures, etc.

215 – 11. Confined space entry.

215 – 12. EHS.

216 – 1. To identify damaged or malfunctioning respirators before they are used.

216 – 2. The possibility of dermatitis if quaternary ammonium salts are not completely rinsed from the respirator.

216 – 3. Can cause valve leakage and sticking.

216 – 4. For a better chance of fitting all personnel and worker acceptance.

216 – 5. If the hair passes between the face and the sealing surface or if the moustache or beard interferes with the function of the respirator valve.

216 – 6. Tight-fitting facepieces.

216 – 7. Because the smoke is highly irritating.

216 – 8. The wearer reacts involuntarily to leakage by coughing or sneezing.

216 – 9. The test should be terminated immediately and the respirator removed.

CHAPTER 4

217 – 1. Prior to noise exposure.
217 – 2. The undesirable effects of noise and the need for and proper use of ear-protective devices. Supervisors must realize and accept responsibility for ensuring that their workers are trained in these areas also.
217 – 3. Motivation and conviction of each person towards hearing conservation.
217 – 4. Effects of noise; prevention of hearing loss; recognition of potentially hazardous noise areas; where to go for possible hearing or noise problems; types, care, and maintenance of the various types of hearing devices.
217 – 5. Audiology Function (NGFA), USAF School of Aerospace Medicine, Brooks AFB TX 78235–5000.

218 – 1. Overexposure to potentially hazardous noise levels.
218 – 2. Because an accumulation of noise exposures (both on and off duty) can cause noise-induced hearing losses.
218 – 3. Ear plugs reduce the noise in the mid and high frequencies, thus allowing speech frequencies to be heard by the person clearer.
218 – 4. Semi-insert device.

219 – 1. Twenty-five percent.
219 – 2. Comfortable, properly sized, properly inserted and oriented in the external ear canal, and that the behavioral attitudes relative to wearing the protectors are acceptable.
219 – 3. Washed in lukewarm water using hand soap as a cleanser, rinsed in clear water, and dried before the next use.
219 – 4. Ear muff cushions should be kept clean; they should be cleaned in the same manner as earplugs, being careful not to get the inside elements of the muff wet.

220 – 1. Enter code M with the current date of the examination.
220 – 2. Compare the annual test results with the reference audiometric test; review 15- and 40-hour test results; monitor recommendations on patients referred to the USAF hearing diagnostic centers or audiologists, and initiate any necessary profile changes.
220 – 3. The effects of noise, proper wear of ear protection, and how to care for these devices.
220 – 4. To ensure that workers are wearing their ear-protective devices and to conduct health education.

221 – 1. A shift in hearing sensitivity of 20 dB or more at the frequencies of 1000, 2000, 3000, and 4000 in either ear is considered significant.
221 – 2. The person should be referred to a USAF hearing conservation diagnostic center, to the base audiologist, or entered in the detailed followup monitoring.
221 – 3. In areas where noise levels are below 75 dBA.
221 – 4. To determine if the hearing loss continues to increase over time.
221 – 5. Refer the patient to a USAF hearing conservation diagnostic center.
221 – 6. Re-establish the reference examination.
221 – 7. To check for a hearing loss when unusual circumstances exist, such as when personnel are employed in extreme noise areas, when noise levels are unknown; or when personnel working in hazardous noise areas cannot be adequately protected due to medical reasons.

1985-631-028/20619 AUGAFS,AL(860651)800

STOP- 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE VOLUME REVIEW EXERCISE

90850 02 25

OCCUPATIONAL MEDICINE

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (200) In cold temperatures how does the body attempt to generate heat within the body tissues?

   a. Through perspiration.
   b. By shivering.
   c. By dilation of the blood vessels.
   d. By lowering the core temperature.

2. (200) What is the dose of an agent producing death in fifty percent of the dosed animals?

   a. Lethal dose - 50 (LD_{50}).
   b. Lethal ceiling - 50 (LC_{50}).
   c. Threshold limit valve (TLV).
   d. Permissible exposure limit - 50 (PEL_{50}).

3 (200) A substance causing an inflammation of the mucous membrane of the respiratory tract is referred to as an

   a. asphyxiant.
   b. irritant.
   c. anesthetic.
   d. hepatotoxic agent.

4. (200) Methyl mercury, tetraethyl lead, and carbon disulfide are examples of

   a. hepatotoxic agents.
   b. asphyxiants.
   c. neurotoxic agents.
   d. anesthetics.

5. (201) Examples of aromatic hydrocarbons include

   a. gasoline, kerosene, and stoddard solvent.
   b. benzene, toluene, and kerosene.
   c. benzene, toluene, and xylene.
   d. xylene, benzene, and gasoline.

6. (201) Isocyanate inhalation, dermatitis, CNS depression, and liver and kidney damage are *major* health hazards associated with which of the following shops?

   a. Battery shops.
   b. Corrosion control shop.
   c. Aerospace Ground Equipment repair.
   d. Non-destructive inspection.

7. (201) Anesthetic gases and radiation are two hazards associated with which area in the hospital?

   a. Medical x-ray.
   b. Laboratory.
   c. Surgery.
   d. Dental and dental labs.

8. (202) Which of the following describes replacing one toxic material with a less toxic one in order to reduce an industrial health hazard?

   a. Substitution.
   b. Isolation.
   c. Administrative.
   d. Engineering controls.

9. (203) Who initiates the AF Form 190, Occupational Illness/Injury Report?

   a. Physical Examination Section Technician.
   b. Environmental Health Services.
   c. The physician.
   d. The medical technician.

10. (204) During which stage of pregnancy is the chance for malformations and abnormalities the greatest?

   a. After implantation and until the third month.
   b. After twelve weeks and before twenty weeks.
   c. Prior to implantation and 1 week after.
   d. Prior to implantation and until approximately 8 weeks.

11. (205) On pregnant women, who initiates the SF 513 requesting recommendations concerning restrictions of duty?

   a. Member's commander.
   b. The health care provider.
   c. Physical examination section.
   d. Patient affairs section.

12. (205) When doing pregnant worker evaluations, if you need additional information concerning the work environment what should you do?

   a. Forward a copy of the SF 513 to the BEE requesting an evaluation.
   b. Forward a copy of the AF Form 422 to her supervisor.
   c. Remove the individual from the shop.
   d. Consult the health care provider who originally saw the patient.

13. (206) What is the *primary* purpose of health education training programs?

   a. Educate worker concerning responsibilities on the job.
   b. Inform worker how to apply for compensation claims.
   c. Reduce the incidence of repeated job-related accidents.
   d. Reduce industry operating costs and increase production.

14. (206) How long must records indicating the health education training provided to the worker be maintained?

   a. 1 year.
   b. 3 years.
   c. 5 years.
   d. 10 years.

15. (206) How can you use the Hazardous Material Information System (HMIS)?

   a. To notify OSHA of industrial accidents.
   b. To inform workers about industrial hazards and the measures necessary to control them.
   c. As an inventory of all hazardous materials located on your base.
   d. For designing your occupational examinations for industrial exposures.

16. (207) Who determines the type, frequency, and extent of occupational medical examinations?

   a. DBMS.
   b. Environmental Health Services.
   c. Physical Examination Section.
   d. Aerospace Medicine Council.

17. (207) If medical examinations are required they should as a minimum include

a. baseline and periodic (quarterly) examinations.
b. medical and chemical history from time of employment only.
c. a biological indicator of exposure if one exists.
d. extensive diagnostic tests to detect physiological changes.

18. (208) Why is the Standardized Occupational Health Program important in the accomplishment of the Air Force mission?

a. We have sophisticated missile systems which must be maintained.
b. Our airman must be in top mental and physical condition to operate high performance aircraft.
c. To maintain an effective fighting force.
d. All of the above are important reasons.

19. (209) Which of the following *must* be evaluated if an absorption, skin or ingestion potential of a toxic material is present in the workplace?

a. Engineering controls.
b. Work practices, *i.e.* sanitation of break areas, wear of protective equipment.
c. Supervisor's training program.
d. Frequency of evaluation of the physical exposures in the shop.

20. (209) Which AF Form is used to summarize the workers exposure in the health record?

a. AF Form 2754, Chronological Record of Workplace Surveillance.
b. AF Form 2755, Master Workplace Exposure Data Summary.
c. AF Form 2758, Industrial Hygiene Survey Data Sheet.
d. AF Form 2767, Occupational Health Training and Protective Equipment Fit Testing.

21. (209) Which of the following hazards has a lot of emphasis placed on preventive controls because a proper evaluation of the workers exposure is usually difficult?

a. Physical hazards.
b. Chemical hazards.
c. Biological hazards.
d. Radiological hazards.

22. (210) The workplace identifier (WI) consists of three sets of four digits. The type of organization and work function is designated in the

a. first set.
b. middle set.
c. last set.
d. the first and last set.

23. (210) What is the major advantage of using the workplace identifier (WI) system for identifying industrial areas?

a. It provides for easy hazard identification.
b. It allows supervisors to procure safety supplies faster.
c. It provides an effective assignment code for personnel.
d. It allows for data to be stored, sorted, and retrieved easier.

24. (210) How many tabs are there in the industrial case file?

a. Six.
b. Seven.
c. Eight.
d. Nine.

25. (210) In Tab C of the industrial case file, you can find which type of information concerning the industrial workplace?

a. Physical agent exposures.	c. Biological agent exposures.
b. Chemical agent exposures.	d. Toxicological exposure reports.

26. (211) An occupational examination which is accomplished to determine the workers capabilities and limitations in relation to job requirements is called a

a. preplacement examination.	c. periodic examination.
b. special purpose examination.	d. termination examination.

27. (211) Where can you look for information concerning basic occupational health examinations required by Air Force publications?

a. AFR 161-33, The Aerospace Medicine Program.
b. AFR 161-6, Control of Communicable Diseases.
c. AFOSH Standard 127-66, General Industrial Operations.
d. AFOSH Standard 161-17, Standardized Occupational Health Program.

28. (211) Which roster should you initially request to "clean-up" the present codes and dates of examinations?

a. Monthly occupational examination roster.
b. Occupational roster.
c. Master computer roster.
d. Newcomer's roster.

29. (211) How are individuals who no longer require a physical (e.g. left PCS) identified on the Occupational Verification roster?

a. Draw a line through the name only.
b. Line through the entire worker's information.
c. Line out the worker's data and write "remove from roster-PCS".
d. Line out worker's data and write DELETE - PCS in bold letters.

30. (211) Which form serves as part I of the occupational health examination?

a. AF Form 2754, Chronological Record of Workplace Surveillance.
b. AF Form 2755, Master Workplace Summary.
c. AF Form 2767, Occupational Health Training and Protective Equipment Fit Testing.
d. AF Form 2770, Assessment and Disposition.

31. (211) Upon completion of the workers examination, a written medical opinion of the results of the workers occupational health examination is recorded on the AF Form

a. 2770, Assessment and Disposition.
b. 2755, Master Workplace Exposure Data Summary.
c. 2769, Supplemental Data Sheet.
d. 2766, Clinical Occupational Health Examination Requirements.

32. (212) Where should you document results of your epidemiological summary of the worker and the workplace?

a. In a log book maintained in your office.
b. On the AF Form 2754, Chronological Record of Workplace Surveillance.
c. On the AF Form 2770, Assessment and Disposition Record.
d. On the AF Form 2755, Master Workplace Exposure Data Summary.

33. (213) Which type of respirators may be used in oxygen-deficient atmospheres?

a. Air purifying and air-line.
b. Air supplied and SCBA.
c. SCBA and air purifying.
d. Canister and SCBA.

34. (213) In the open-circuit type of SCBA the air time of the cylinder is generally

a. 15 minutes.
b. 30 minutes.
c. 45 minutes.
d. 60 minutes.

35. (214) When should you provide initial use training to all workers?

a. Prior to PCS assignment.
b. Prior to first use of a respirator.
c. Upon first PCS assignment.
d. Upon being placed in a supervisory position.

36. (214) Environmental health service (EHS) should provide technical guidance to supervisors in

a. counseling respirator wearers.
b. procuring makes and models of respirators.
c. determining the need for respirators.
d. implementing requests for engineering controls.

37. (214) Workers who wear respirators for emergency escape or rescue *must* receive refresher training

a. from EHS personnel.
b. from the respirator manufacturer.
c. on an annual basis.
d. once every six months.

38. (214) Refresher respirator training conducted in the unit for workers required to use respirators on a routine basis is the unit commander responsibility and should be given

a. semi-annually.
b. as necessary.
c. prior to use.
d. annually.

39. (215) Prospective respirator users should be evaluated for evidence of pulmonary impairments, to include

a. high blood pressure.
b. bronchial asthma.
c. angina pectoris.
d. inactive tuberculosis.

40. (215) The respirator certification card is

a. maintained by supervisors.
b. locally designed.
c. placed in medical records.
d. issued annually.

41. (216) An air-purifying respirator used by more than one particular worker *must* be

a. stored with canisters and filters.
b. cleaned and sanitized after each use.
c. inspected after each use and monthly.
d. returned to stock at the end of the day.

42. (216) As minimum, common-use respirators should be cleaned and disinfected

a. before and after each use.
b. as frequently as necessary to prevent dermatitis.
c. after each use.
d. after each use and during monthly inspections.

43. (216) Respirators should be stored on a shelf in a single layer to prevent

a. insect and rodent infestation.
b. the facepiece from being distorted.
c. workers using the device incorrectly.
d. the cartridges from being cracked.

44. (216) Spectacles prevent a good facepiece seal when fit testing a worker with a

a. respiratory helmet.
b. half facepiece respirator.
c. full bodied suit.
d. full facepiece respirator.

45. (216) The negative pressure test is recommended for persons wearing

a. all types of respirators.
b. respirators for emergency-use only.
c. tight-fitting respiratory inlet coverings.
d. canister-type facepieces only.

46. (216) Positive and negative pressure tests should be conducted

a. daily.
b. only when cartridge is changed.
c. each time the respirator is put on.
d. before entry into oxygen-deficient atmospheres.

47. (217) When should occupational health education be scheduled for persons newly exposed to hazardous noise?

a. When they go to the medical facility for their annual examination.
b. When they go to the medical facility for their 90-day examination.
c. During the first few days of exposure.
d. During the safety inspections of the workplace.

48. (217) Who is responsible for routinely inspecting each worker's personal ear protective devices?

a. The individual worker.
b. The workers immediate supervisor.
c. Safety inspection personnel.
d. Environmental health personnel.

49. (218) The initial loss in hearing that results from excessive noise exposure is normally in the

a. 500 Hz range.
b. 1000 Hz range.
c. 3000 Hz range.
d. 4000 Hz range.

50. (218) Generally, a properly fitted earplug or muff reduces the amplitude of noise by approximately how much?

a. 10 dB.
c. 30 dB.
b. 20 dB.
d. 40 dB.

51. (219) How should earplugs be cleaned?

a. Clean and disinfect using a chlorine and water solution.
b. Wash in warm water using hand soap and rinse in clear water.
c. Wash in warm water with iodine and soap solution then rinse in clear water.
d. Wash in warm water using hand soap and disinfect with a quarnary ammonium solution.

52. (219) How often should earplugs be cleaned if they are not used daily?

a. After each use.
c. At the supervisors direction.
b. Once a week.
d. Once a month.

53. (220) The computer code which requires *only* an annual hearing test is

a. M.
c. T.
b. O.
d. K.

54. (220) Where do you document earplug fitting and training?

a. In a log book maintained in your office.
b. On the AF Form 2755.
c. On the AF Form 2767.
d. On a memo for the record to be filed in the health education folder.

55. (220) Why should you visit the workplace of noise exposed personnel?

a. To cite personnel not complying with safety requirements.
b. To determine occupational physical requirements.
c. To counsel employees who demonstrate a loss in hearing on their annual hearing tests.
d. To re-enforce how effective ear protective devices are.

56. (221) If a person receiving an annual audiogram demonstrates a significant threshold shift, the person should be

a. referred to an ENT physician.
b. retested in 90 days.
c. retested 15 hours after being away from noise.
d. retested 48 hours after being away from noise.

57. (221) Individuals whose hearing has been found to be stable through detailed follow-up monitoring audiometry are allowed to continue working in potentially hazardous noise career fields. Which audiometric exam result is used to establish a revised reference for subsequent annual audiograms?

a. 90 day.
c. 40 hour noise-free.
b. 15 hour noise-free.
d. Previous annual.

58. (221) What constitutes a significant threshold shift for a 90-day, annual, 15-hour, and 40 hour noise-free hearing test?

a. 20 dB or more at the frequencies of 1000, 2000, 3000, or 4000 in either ear.
b. 20 dB or more only at the frequencies of 3000 or 4000 in either ear.
c. 15 dB or more at the frequencies of 1000, 2000, 3000, or 4000 in either ear.
d. 15 dB or more at the frequencies of 2000, 3000, or 4000 in either ear.

59. (221) What constitutes a significant threshold shift during a detailed follow-up examination?

a. 15 dB or more at the frequencies of 1000, 2000, 3000, or 4000 in either ear.
b. 10 dB or more at the frequencies of 1000, 2000, 3000, or 4000 in either ear.
c. 15 dB or more at the frequencies of 3000 or 4000 in either ear.
d. 10 dB or more at the frequencies of 3000 or 4000 in either ear.

60. (221) If a patient has a significant threshold shift during a detailed follow-up examination he or she should be

a. referred to a USAF Hearing Conservation Diagnostic Center.
b. readministered a 40-hour noise free examination.
c. permanently removed from all duties involving noise.
d. readministered a 15-hour noise-free examination.

END OF EXERCISE

MAIL TO: ECI, GUNTER AFS AL 36118-5643

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012. PRINCIPAL PURPOSE: To provide student assistance as requested by individual students. ROUTINE USES: This form is shipped with ECI course package and used by the student, as needed, to place an inquiry with ECI. DISCLOSURE: Voluntary. The information requested on this form is needed for expeditious handling of the student's inquiry. Failure to provide all information would result in slower action or inability to provide assistance to the student.

I CORRECTED OR LATEST ENROLLMENT DATA

1. THIS REQUEST CONCERNS COURSE (1-6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER

5. SOCIAL SECURITY NUMBER (7-15) – –	6. GRADE/RANK	7. NAME (First initial, second initial, last name) (17) – (18) – (19-32)

8. ADDRESS OJT ENROLLEES: Address of unit training office with zip code. ALL OTHERS: Current mailing address with zip code.	(33-53) (54-75)
9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE	10. TEST CONTROL OFFICE ZIP CODE/SHRED (33-39)

II REQUEST FOR MATERIALS, RECORDS, OR SERVICE

Place an "X" through number in box to left of service requested.

1. Request address change as indicated in Section I, Block 8.
2. Request Test Control Office change as indicated in Section I, Block 10.
3. Request name change/correction. *(Provide Old or Incorrect data here)*
4. Request Grade/Rank change/correction.
5. Correct SSAN. *(List incorrect SSAN here.) (Correct SSAN should be shown in Section I.)*
6. Extend course completion date. *(Justify in "Remarks")*
7. Request enrollment cancellation. *(Justify in "Remarks")*
8. Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 10
Originals were: [ ] Not received [ ] Lost [ ] Misused
9. Send course materials. *(Specify in "Remarks")*
[ ] Not received [ ] Lost [ ] Damaged
10. Course exam not yet received. Final VRE submitted for grading on ____________ (date).
11. Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 10 not yet received. Answer sheet(s) submitted ____________ (date).
12. Results for CE not yet received. Answer sheet submitted to ECI on ____________ (date).
13. Previous inquiry ([ ] ECI Fm 17, [ ] ltr, [ ] msg) sent to ECI on ____________ (date).
14. Give instructional assistance as requested on reverse.
15. Other *(Explain fully in "Remarks")*

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K	VOL 33-35	GR 36-38
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REMARKS *(If continued use reverse)*

OJT KEY DUTY ENROLLEES must have their OJT Administrator certify this record.

ALL OTHER ENROLLEES may certify their own requests.

I certify that the information on this form is accurate and that this request cannot be answered at this station.

SIGNATURE

ECI FORM DEC 84 17 PREVIOUS EDITION WILL BE USED.

SECTION III: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

VRE Item Questioned:

Course No ____________

Volume No ____________

VRE Form No ____________

VRE Item No ____________

Answer You Chose ________ (Letter)

Has VRE Answer Sheet been submitted for grading?

☐ Yes ☐ No

REFERENCE

(Textual reference for the answer I chose can be found as shown below)

In Volume No ____________

On Page No ____________

In ☐ left ☐ right column

Lines _____ Through _____

MY QUESTION IS:

REMARKS

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. Course workbooks have a Form 17 printed on the last page.

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CDC 90850

ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

Volume 3

Facility Sanitation and Environmental Surveys

Extension Course Institute

Air University

332

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Preface

THE THIRD volume of this 90850 CDC covers environmental surveys and food facility sanitation evaluations. Chapter 1 discusses the medical aspects of these two inspection programs. It covers the special problems associated with the facilities you'll evaluate under the specific inspection programs, and it also gives you some practice at evaluating your own reports. Chapter 2 deals with the inspections you'll perform in the special environments found on most military installations.

Code numbers appearing on figures are for preparing agency identification only.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

This volume is valued at 15 hours (5 points).

Material in this volume is technically accurate, adequate, and current as of February 1984.

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The Medical Aspects of Surveys and Evaluations

THE QUALITY of the living and working environment directly impacts on a person's ability to function as a productive and healthy member of society. It affects a person's morale, mental and physical well-being, safety, and motivation.

The environmental surveys and food service sanitation evaluations you perform are intended to be a continuing effort to maintain, or improve where necessary, the living and working environment of Air Force military and civilian personnel.

We perform surveys and evaluations as technicians. We observe, document our observations, and make written reports on existing conditions. Air Force personnel use our written reports as a basis for making meaningful corrections. We are not enforcement specialists — we are observers and recorders. Our specialty is education — education should become the major emphasis of our work in this area — showing people how to safeguard their health and well-being. You cannot educate unless you first understand the reasons behind the requirements. In this volume, you're going to learn the reasons behind our environmental and sanitation requirements, as well as the ways in which you'll apply those requirements to the facilities and people you'll be evaluating.

In that spirit, we enter into a discussion of the medical aspects of environmental surveys and food service sanitation evaluations.

1-1. Medicine in the Environment

Long before the development of modern principles of public health, health care providers recognized certain relationships between the environment and the outbreak of disease. Before micro-organisms were discovered, it was a common belief that the atmosphere was the probable vehicle for disease. Typhoid and cholera flourished where human waste was allowed to contaminate the environment. It was assumed that noxious vapors, or miasmas, from these wastes caused the disease outbreaks. Another example would be the severe recurring fevers that occurred in low-lying marshy areas of the world. Outbreaks of fever were attributed to "bad air" and the fevers became known as malarias. Only with the advent of scientific knowledge did these beliefs finally give way.

400. Define environmental health concerns as they relate to environmental surveys and food facility sanitation evaluations.

The earliest concern for environmental health, or public health, activity was motivated by a need to control serious and widespread epidemics. Today, the primary purpose of environmental health programs is to establish, provide, and maintain conditions necessary for the prevention of disease. The medical aspects of environmental health activities exist within such broad conceptual areas that constant research and study is required. Research and study is conducted in areas such as disease vector population control, sewage and waste disposal, food handling and food preparation, milk pasteurization, water supply evaluation and certification, housing quality standards, the control of occupational diseases, control of ionizing radiation, and quality standards for the air we breathe. Environmental health may now be defined as the science of controlling or modifying those conditions, influences, or forces that relate to promoting, establishing, and maintaining physical and mental well-being.

Environmental surveys and food facility sanitation evaluations are part of the Environmental Health Office's activities because they allow for the observation of the environment. Specialists can observe the "... conditions, influences, and forces surrounding man ..." and make a qualified report to their superiors on ways to "... control, or modify ..." those conditions to "... promote, establish, and maintain the physical and mental well-being ..." of a given population.

Well-trained and competent environmental medicine specialists and technicians are needed to convey the ideals of good public health practice to workers and supervisors, health care providers, and commanders. It isn't easy to require high standards and still maintain a working rapport. If you consider the effects of inadequate public health precautions on the Air Force mission, the possibility of death, or aircraft loss because you aren't doing your job, then you should be able to form a fairly accurate picture of the importance of sound public health education, evaluation, and maintenance.

Environmental surveys. Hazards to physical and mental well-being may arise unexpectedly from sources that are thought to be under adequate control. Since hazards of this type are relatively new, they may go undetected for some time. We perform environmental surveys in order to identify such hazards, if they exist, and to control the environment around our personnel to protect them from the harmful effects of known and unknown contaminants. For example, you will survey barber and beauty shops, child care centers, gyms, etc.

Food facility sanitation evaluations. The majority of foodborne illnesses are nonfatal. There are some records of death from heart attack or the rupturing of a vital organ attributed to the symptoms of foodborne illness. It is a known fact that the organism *Clostridium botulinum* kills about 23 percent of the people it afflicts. Outbreaks of disease can be disastrous among a weakened population such as patients in a hospital or elderly persons. Institutional feeding situations seem to provide a better environment for potential foodborne disease outbreak — more cases of foodborne illness are reported from this type of feeding situation than from any other. Large numbers of people are usually affected when an institutional feeding service provides the environment for an outbreak of foodborne disease. The military is, for the most part, one big institutional feeding organization. Think of the chaos if an illness were to occur in one of the Air Force's student squadrons or in a bomber crew alert facility. Food facility sanitation evaluation is a good example of this concept. AFR 163-8, *Control of Foodborne Disease*, indicates that the primary purpose of performing food establishment sanitation evaluations is to control and prevent the outbreak of foodborne illness.

Food is essential in promoting the health and mental well-being of the military member. Given the various ways in which military members come in contact with food on any particular day, it becomes apparent that our sanitation evaluations are essential to the protection of their health.

Exercises (400):

1. What motivated the earliest concern for environmental health?

2. State the primary purpose of modern environmental health programs.

3. Why are food facility sanitation evaluations a good example of the primary purpose of environmental health programs?

4. Define environmental health.

5. Why do environmental medicine specialists and technicians perform environmental surveys?

6. Why are food facility sanitation evaluations important?

401. Distinguish among common medical aspects of environmental surveys and food facility sanitation evaluations as to purpose and definition.

Common Health Concern. There are major areas of public health concern that relate to both the environmental survey and the food facility sanitation evaluation. Each, by itself, is an important aspect of promoting, establishing, and maintaining the physical and mental health of our Air Force population. Together, these areas of public health are the link between safe and effective mission accomplishment and the continued well-being of all our people.

These four areas of concern are:

(1) Protection from contamination.
(2) Cleaning and sanitizing.
(3) Pest control.
(4) Employee health.

Protection from contamination. Please refer to the Chain of Infection discussed previously. A contaminant is anything that, when introduced into the body, would cause illness, injury, or death. We're concerned with the method of entry for these contaminants — breathing, absorption, ingestion. Any route of entry into the body must be properly and reasonable protected against unwilling contamination. Workers must understand this and apply techniques for preventing their own injury or illness. They must also understand and apply these same techniques to prevent injury or illness to their coworkers. It's a "team concept" approach — no one can operate alone in our modern environment without endangering someone else — and it requires everyone's understanding. Remember our stress on education? The worker knows the job and all the shortcuts in getting a job done. You know all the reasons why most shortcuts are faulty and dangerous. You need to be educating the worker. Food handlers, welders, painters, engine mechanics — they all need protection and they all need education.

Cleaning and sanitizing. The act of cleaning is defined as the visible removal of soil from a surface or area. Effective cleaning requires the complete removal of those same soils. Yet, a clean surface does not safeguard people from disease. A "clean" surface may still harbor millions of pathogenic micro-organisms. In order to prevent the spread of these to the human body, we require that surfaces used in preparing, serving, and storing foods be sanitized. We require that utensils and surfaces that come in contact with the human body be sanitized.

The act of sanitizing is defined as reducing the number of pathogenic and other micro-organisms to a safe level. This is done by the use of heat or chemicals, depending on the size of the surface to be sanitized, and the amount of use that surface will receive in the course of a workday. In hospital areas, both heat and chemicals are used. Heat is often used to sanitize (or disinfect) surgical instruments, dining utensils, and clothing. Chemicals are used to sanitize (or disinfect) floors, walls, skin, utensils, and equipment.

In food service operations, both heat and chemicals are used in sanitization. Heat is used to sanitize utensils and equipment and to render foods safe to eat. Chemicals are used to sanitize large equipment, utensils, and the hands of people who will handle foods. When people come into contact with other people — either directly as in the case of the hospital or perhaps the child care center, or indirectly as is the case in food handling facilities — they must understand and apply the techniques of good cleaning and sanitizing to their environment if the transmission of disease is to be controlled or prevented.

Pest control. Insects and rodents do transmit disease. They invade dwellings, destroy or spoil millions of dollars worth of food, and spread disease. Active pest control not only protects the general health of the public but the financial interests of the Government.

We are interested in the control of all insects and rodents. Some insects, such as mosquitoes, ticks, and lice, transmit disease without ever affecting our foods because active measures for cleaning the environment have not been established in an area. Some insects are of public health concern solely for the damage they do to our foods, such as certain types of moths, weevils, or beetles. Still other types of insects such as flies and cockroaches are a double threat because they affect our food supplies and can transmit disease to people without spoiling a given food supply.

Rodents are of public health significance because they may destroy or damage food supplies, they may act as a disease reservoir, or they may be disease vectors. Their importance is no less significant then that of the insect. Active control and eradication measures are a must when operating a public health program.

Employee health. Human beings are, unfortunately, the single most common cause of illness and injury in both the work and living environment. Ignorance, inattention, laziness — all these wonderfully human traits usually add up to injury and illness for ourselves and others. However we touch our environment — with our hands, our perspiration, our breath — we spread bacteria and other micro-organisms. As we spread our bacteria, we ignore our surroundings and attempt to circumvent the established procedures. Surely we know the better way for accomplishing our jobs. It's only when we're hurt or sick that we even begin to ponder our own habits. It is ironic that people are both the culprit and the victim in most injuries and illnesses.

Medical importance. The importance of these health concerns to both the environmental survey and the food facility sanitation evaluation, lies in their potential for causing mission deterioration and failure, as well as the potential for a disease outbreak in epidemic proportions. It isn't enough for the worker in a child care center to practice good food-handling techniques and ignore personal hygiene; the outbreak of disease could still occur. It isn't enough for the worker in a civil engineering paint shop to understand the reasons why respirators are necessary in that environment — the respirator must be worn. Injury or illness could still occur. It isn't enough for the Environmental Medicine Specialist or Technician to understand all the ways in which an injury or illness can occur or be prevented if that individual isn't trying to educate the base population about the ways in which they can be protected.

Exercises (401):

1. What link is formed by the common medical aspects of environmental surveys and food facility sanitation evaluations?

2. List the common medical aspects of environmental surveys and food facility sanitation evaluations.

3. What is the definition of a contaminant?

4. When we try to protect people from contamination, with what factor are we mostly concerned?

5. List the definitions of cleaning and sanitizing.

6. What are two ways that sanitizaiton can be accomplished?

7. What do we accomplish by controlling pests?

8. Why are we interested in the control of insects?

9. Why are we interested in the control of rodents?

10. Why are humans important when discussing disease prevention and control?

11. State the importance of the health concerns common to environmental surveys and food facility sanitation evaluations.

12. Though the environmental medicine specialist or technician knows the ways disease and injury occur, in what areas must your emphasis be?

402. Cite those aspects of environmental surveys that are of importance to the environmental medicine specialist.

Medical Aspects of Environmental Surveys. The lack of comfort, privacy, or facilities to care for personal needs can cause hardship adequate to deteriorate both physical and mental health. Air Force personnel have to be ready — all of the time — to give their best effort in the defense of this nation. It's hard to conceive of airmen giving their best when they are too tired or too ill, too hungry or too angry to concentrate on the job at hand. Because the physical and mental well-being of an individual can be altered by the environment, we consider the following factors as medical aspects associated with environmental surveys:

a. Lighting.
b. Ventilation.
c. Space.

Lighting. Light is given off from the sun in a series of waves. These light waves are a form of radiation to which the eye is very sensitive. Various light wave lengths are seen by the eye as separate colors, or shades of light or color. Poor lighting is a causative factor in producing eye strain as well as increasing the incident of accidents in the home and workplace. Poor lighting makes it difficult to work effectively or efficiently. Sunlight is the best form of light but highly impractical as a light source in most working environments. Therefore, we provide artificial light. Artificial lighting, however, must provide the worker with enough light so that safe and effective work can be produced.

The Air Force has a series of lighting standards based on the type of work done and the area where the work is normally accomplished. For example, in a food service operation, a worker preparing foods at a preparation table must have 70 foot-candles of light available, whereas a worker storing foods in a dry storage area needs only 20 foot-candles. (See fig. 1-1 for an illustration of foot-candle measurement)

Ventilation. Ventilation is a process of supplying and removing air by natural or mechanical means to or from a given space. A simple rule for our use is this one: ventilation provides what is needed for an occupant of a space — either a working or live-in occupant — and removes what may be harmful to the occupant from that space. The various factors associated with the ventilation of facilities aren't important to you. What is important to you is that the worker has a healthy work environment. Ventilation is one way to control a hazardous or uncomfortable work environment.

Personnel who work in areas where toxic chemicals are used, where toxic or irritant fumes are produced, or where the work procedure produces an uncomfortable environment, need adequate ventilation. It is a sore point with you if your dormitory room is too cold in the winter or too hot in the summer. To the worker, poor ventilation can produce long-term health problems. The factors of temperature, humidity, and air movement must be considered when looking at ventilation. Is the area where the work is being done too humid? Too hot? Is the air movement inadequate to dilute or erase the toxic fumes, gases, or vapors? Is dilution, or local exhaust ventilation (LEV) required? (See fig. 1-2 for an illustration of these two types of ventilation — these are normally used in industrial areas for removal of contaminants.) You must be able to recognize these problems readily and request evaluation from Bioenvironmental Engineering. This combined effort helps create a healthier work environment.

Space. Human beings are, by nature, private animals. We all need a place where we can go and collect our thoughts, relax, and let the stress of living fade away. We also need a certain amount of space in which to live, store our belongings, take care of our private needs, socialize, and produce work. The Air Force sets standards for most buildings it constructs, allowing a certain amount of square footage for occupants who must live, eat, or produce work within the specific building. Depending upon where you live, what your rank is, and what your specific duties in the Air Force are, you are allotted a certain amount of space in which to function. This setting of space requirements also allows for a certain amount of control over the spread of communicable disease. The less compacted we humans are in any given space the less likely it is that we'll come down with this year's flu "bug." Again, spacing also relates to the mental well-being of us all. The more space we have in which to work, the more effective and efficient we become.

Exercises (402):

1. When does the environment medically affect an individual?

2. What is light?

3. How does poor lighting affect the worker?

4. Define ventilation.

5. State the simple rule of ventilation used by environmental medicine specialists and technicians.

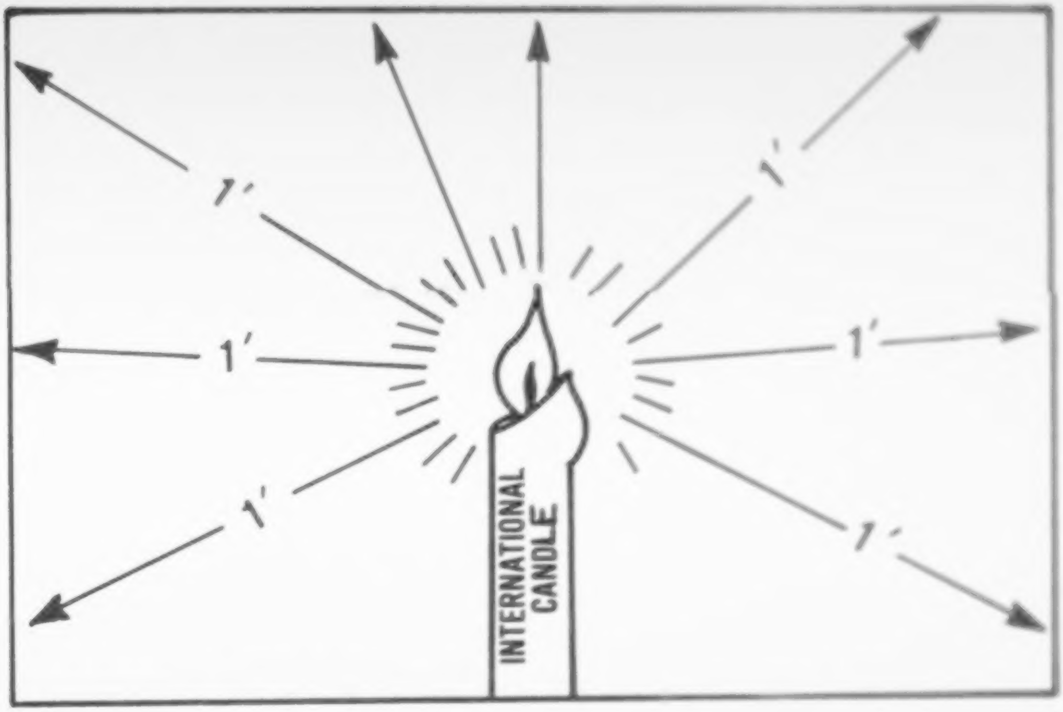

Figure 1-1 How a foot-candle is defined.

6. Why is space important to human beings?

7. List the criteria used by the Air Force for determining how much space you need.

8. When we set spacing standards, we are dealing with what two medical concern?

403. Cite those aspects of food facility sanitation evaluations that are of importance to the environmental medicine specialist.

Medical Aspects of Food Facility Sanitation Evaluations. Food is essential to the continued well-being of the human being. Given the need to eat and the potential for illness that is constant in food facilities, the medical concerns associated with food service operations carry significant weight. Some of these medical aspects are:

a. Food-handling techniques.
b. Food-preparation techniques.
c. Food wholesomeness.
d. Food-storage techniques.

Food handling techniques. Any discussion of food-handling techniques needs to cover the types of food being prepared and the time-and-temperature relationship that is critical to disease prevention. The food handler is going to come in contact with raw foods and must use every precaution in order to prevent the recontamination of prepared foods. Preventing recontamination requires the food handler to have a knowledge of some of the common medical aspects associated with environmental surveys and food facility sanitation evaluations. Food handlers must be aware of the procedures for cleaning and sanitizing their work areas and the tools they use in preparing and serving foods. They must know the basic personal hygiene requirements of a food handler and practice them diligently. They must understand and apply the proper storage temperatures and times to various food items. (See fig. 1-3, Critical Temperature Zones)

The fact that temperature plays such an important role in the prevention of, or the onset of, foodborne illness must be stressed to everyone who handles food. The longer foods are allowed to remain at temperatures that aid in the growth of harmful micro-organisms, the

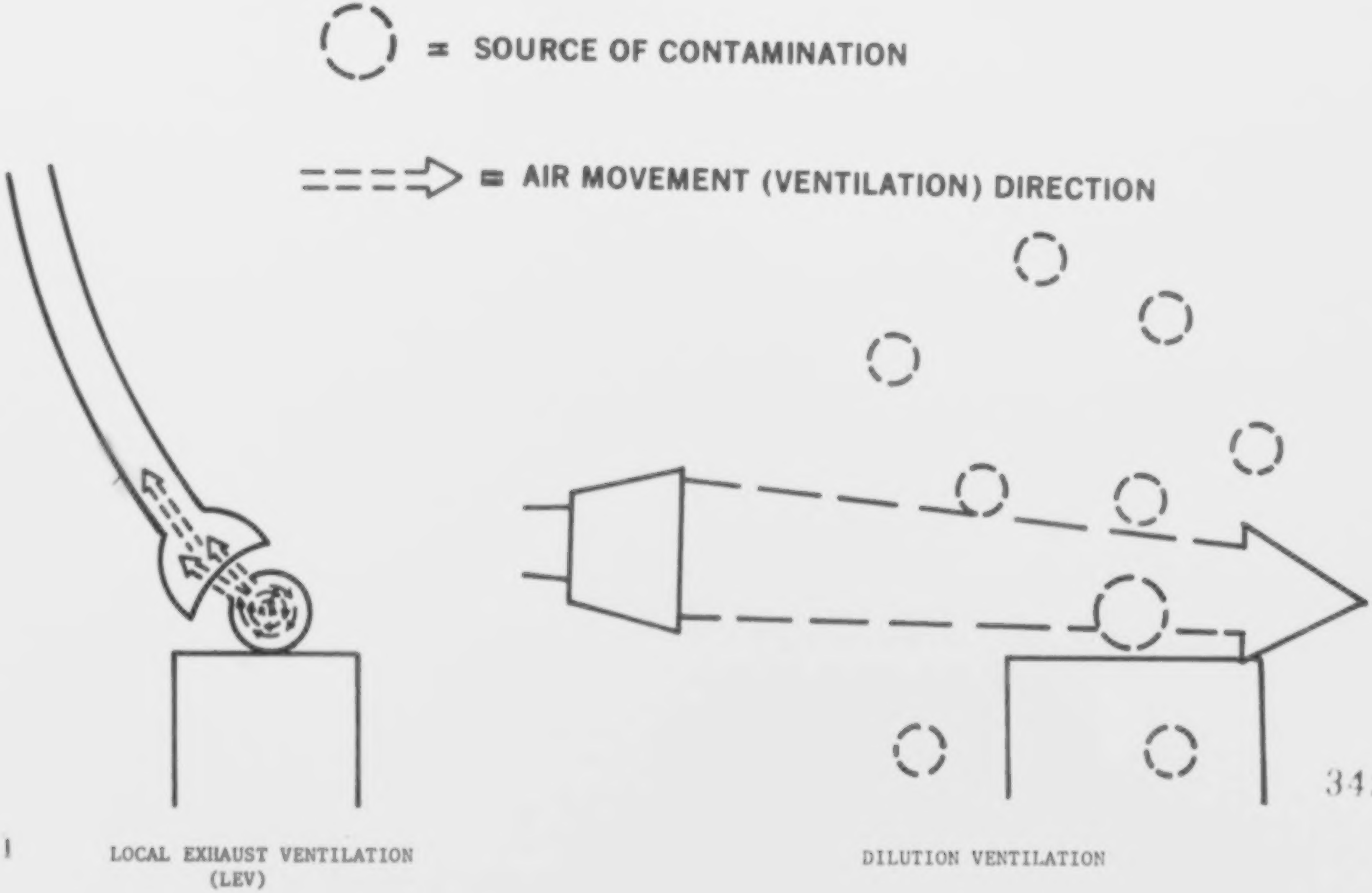
= SOURCE OF CONTAMINATION
= AIR MOVEMENT (VENTILATION) DIRECTION
LOCAL EXHAUST VENTILATION (LEV)
DILUTION VENTILATION

Figure 1-2 Types of ventilation.

-------- 212°F --

Bacteria die — Cooking food

-------- 165°F --

Bacteria will not grow — Holding food hot for serving

-------- 140°F --

DANGER ZONE:

Bacteria will grow — Foods are not to be kept in this temperature zone.

Exception: For short times while preparing or while serving

-------- 45°F --

Bacteria will grow slowly — Chilling foods

-------- 32°F --

Bacteria won't grow, but will live

-------- 0°F ---------------------------- Frozen food

Figure 1-3 Critical temperature zones.

more likely that food may become a source of a food-borne illness outbreak. The temperatures established for the safe storage of hot, chilled, and frozen foods inhibit the growth of these micro-organisms. Food handlers must be aware of this critical relationship between temperature and time. A failure to pay close attention to the storage and cooking temperature in a food facility can easily lead to a serious disease occurrence.

Food preparation techniques. It really isn't enough just to know that raw foods are contaminated and that all foods have to be cooked and stored at safe temperatures. A food handler needs to learn why it is important to prepare foods under specific conditions. In order for a food handler to learn this information, you, the environmental medicine specialist, are going to have to provide that food handler with an education about food preparation. Performing facility sanitation evaluations is going to force you to ask some difficult questions. How long before a meal period should you begin preparing a meal? Why that period of time? What is a potentially hazardous food? What must you do to a potentially hazardous food before you use it? Why is it all right to thaw seafood under running potable water, but not beef? There are hundreds and hundreds of individual questions that must be answered — many while you're performing your sanitation evaluation — and you must be the source of the correct answer. If you don't know the answers to these questions or if you begin creating your own reasons why things are done a certain way, after a time you'll find that no one will believe what you're saying. Your credibility will diminish. Research AFR 163-8; know what additional information sources are available to you in your office; and take the time to learn and apply your increasing job knowledge to the problems you encounter.

Food-storage techniques. Keeping foods safe for consumption while protecting the financial interests of the Government — these are the concepts which helped formulate the food storage requirements we use in the Air Force. We want all the foods we serve to be safe but we don't want to waste Government food dollars arguing over what is, or isn't, safe for consumption. We want the storage areas free of debris and food garbage so that the pests (insects and rodents) we discussed earlier won't find the storage area an inviting nesting area. We want the area kept clean and dry so that the containers that protect the stored foods aren't weakened or destroyed, thus allowing product contamination. We don't want foods that are no longer fit for their intended use still "alive" in the supply system. We want those foods removed and properly disposed of. We want the stock rotated so that the oldest product is always used first. We want food items stored away from nonfood items (detergents, insecticides, cleaners, etc.) so that no possibility of contamination exists. Again, we want the food handler to understand and apply good storage techniques. The only way that can occur is if you, the environmental medicine specialist, understand those techniques and can educate the food handler in their proper application.

Exercises (403):

1. List those aspects of food service operations that are of concern during a food facility sanitation evaluation.

2. What topics must you cover when discussing food-handling techniques?

3. When considering food-handling techniques, what are some of the common medical aspects of surveys and evaluations that food handlers have to understand and apply to their duties?

4. Why are time and temperature such important considerations when discussing food-handling techniques?

5. List the two concepts that determine storage criteria for foods.

6. How should food handlers become aware of good food preparation techniques?

1-2. Factors for Environmental Surveys

A few years ago, a young preventive medicine specialist was assigned the responsibility of performing environmental surveys on several of the base facilities. This individual decided that there was no need to go all over the base doing the surveys; it would be much simpler if the reports were all done while sitting in the AAFES Snack Bar. This also provided additional time to make conversation with members of the opposite sex.

After completing the entire week's schedule of surveys in one morning, this airman proceeded to use the rest of the week enjoying the social life of the base.

The reports were all filed, free of any adverse observation, but the shortcut resulted in unnecessary hardship for many people. Had the task been done properly, a survey report would have been done on the local dining hall. That report would have identified several problems in the equipment being used in the facility. A new food warmer had been installed, with a cross connection between the warmer and the water supply. When the food warmer was full, the pressure dropped, forming a vacuum in the water line and allowing back-siphonage to occur, pulling contaminated water into the water supply.

The contaminated water made its way into the drinking fountains where patrons of the dining hall drank it. Several suffered from what was originally thought to be a foodborne illness. Many hours were wasted investigating in the wrong direction. If the surveys had been done correctly the cross-connection problem would have been detected and many illnesses prevented.

In this section, we will discuss common facility requirements established by the Air Force for the safeguarding of public health. We also will discuss specific base facilities and the health requirements associated with each.

404. Give examples of the basic factors associated with performing an environmental survey.

A number of basic sanitary requirements exist for any base facility. Regardless of its size or mission, space requirements, adequate latrines, washrooms, lighting, heating, and ventilation must be available to its occupants. Insect and rodent control measures are necessary; waste disposal must be provided and sometimes special equipment is required because of the type of facility; e.g., showers for gymnasiums, isolation rooms for sick children in nurseries, etc.

Common Requirements. Remember from Volume 2 that the elimination of overcrowding is an important general control measure in preventing the spread of respiratory diseases. Standard floor space requirements depend upon the type of facility, the activity involved (playing, sleeping, eating, etc.), the expected occupancy (children, adult, sick, well, etc.), and other factors. In Table 1-1 you'll find, for each activity, the spacing requirements which have been established or suggested. Adequate toilet and washroom facilities should be available to all facilities, regardless of their function or occupancy. Whenever feasible, the plumbing should be located in the same building; excessive time or distance involved in reaching the latrine or washroom should be avoided. You will find in Table 1-2 standards which should be met under normal conditions.

Where urinals are provided, one urinal may replace one water closet except that the number of urinals must not exceed ⅓ of the total number of fixtures. A 2-foot, acid-resistant, trough-type urinal may be considered as equivalent to one individual urinal. Every urinal should be flushed from a separate water supply system or through flush valves and should use 1 gallon for each discharge.

The door to every toilet room should be fitted with an effective self-closing device and should be screened from persons in the work area. All compartment doors should be supplied with a latch. Floors and side walls to a height of 6 inches should be watertight and impervious to moisture. The floors, walls, and ceilings should be easily cleaned. Every water closet should have an open front (split seat) made of impervious materials or finished with other substances to make it impervious to moisture and allow for proper disinfection.

Chemical closets and privies should not be permitted except where no sewer is accessible. Chemical closets are portable human waste receptacles that contain a chemical used for breaking down human wastes; privies are fixed waste receipt sites without running water. You must stress that privies are not to be erected where seepage or drainage may endanger any drinking water source through contamination. Chemical closet containers should be of a type approved by Civil Engineering and the Director of Base Medical Services (DBMS) and should not be allowed to become more than two-thirds full. Privies should be prohibited for any establishment employing more than 25 persons. No privy should be located within 100 feet of any room where foodstuffs are stored or handled. All toilet rooms with windows should be equipped with screens. In Table 1-3 you'll find that the suggested permissible number of persons allowed for each type of plumbing fixture varies with the type of facility and the total number of people involved. Remember that the recommendations listed in Table 1-3 are optimum, and variations may occur in the maximum or minimum requirements according to individual situations.

An initial survey for adequacy and annual or biannual followups are normally sufficient for lighting, heating, and ventilation efficiency.

Insect and rodent control has already been covered

TABLE 1-1

LIST OF ACTIVITIES AND SPACE REQUIREMENTS

ACTIVITY	SPACE REQUIREMENT
Barracks, Open Bay	72 square feet; beds placed on a minimum of 5 foot centers
Barracks, Dormitory	62 square feet
Barber Shop	Chairs 5 foot from center to center
Places of Assembly (Dining Halls, Dayrooms, Exchanges)	12 square feet
Hospital Wards	100 square feet per bed, or beds on 8 foot centers
Nurseries	35 square feet per child indoors
Playgrounds	50 - 100 square feet per child

TABLE 1-2

RECOMMENDED TOILET FACILITIES

Number of Persons	Minimum Number of Closets
1 - 9	1
10 - 24	2
25 - 49	3
50 - 100	5
Over 100, for each additional 30 persons	1

TABLE 1-3

PLUMBING FIXTURE REQUIREMENTS BASED UPON PERSONS PER FIXTURE

(Figures indicate minimum number of using persons per listed fixture, based on the rated capacity of the facility; one fixture will be provided respectively for the number of persons or fraction of the number shown. The figures in parentheses refer to notes following the table.)

Types of Facilities	*Water Closets*	*Lavatories*	*Urinals*	*Showers*	*Bath-tubs*	*Drinking Fountains*
Administrative types of buildings (1) (5)						
Male						
Up to 30	15	15	30	—	—	75
31 to 120	20	20	40	—	—	75
121 to 300	25	25	50	—	—	75
Female						
Up to 120	15	15	—	—	—	75
121 to 300	20	20	—	—	—	75
Barracks (1) (7)						
Men (2)	10	8	16	16	—	75
Women (3)	6	6	—	10	25-30	75
Bachelor officers' quarters (1) (4) (7)	—	—	—	—	—	—
Messes						
Kitchen personnell (6)						
Men	20	10	40	(6)	—	—
Women	10	10	—	(6)	—	—

Notes on Parenthetical References in Table 1-3

(1) One service sink per floor per company unit will be provided, and where warranted, service sink will be provided for each 100 linear feet (or fraction thereof) of corridor per floor.

(2) One compartment laundry tray will be provided for each group of 50 to 60 persons.

(3) One compartment laundry tray will be provided for the first 25 persons, two compartments for the first 50 persons, and one additional compartment for each additional group of 50 to 60 persons.

(4) Plumbing fixtures will be scheduled as follows: One water closet, two lavatories, and one shower or bathtub for two bedrooms. In addition, a toilet room may be scheduled for the office and lounge.

(5) Fixtures will apply to hobby (craft) shops, post office, banks, and library. Fixtures will be provided only for operating personnel in post offices and banks. Joint-use fixtures will be provided in hobby (craft) shops for operating personnel and patrons on this basis.

(6) Kitchen Personnel:
Service sinks: One per kitchen area, maximum of one in dining hall.
Lavatories:
Kitchen: One minimum; two for 2,000-man mess facility; three for 3,000-man mess facility.
Serving-counter area: One minimum; two for 1,000-man mess and larger.
Toilet: One common toilet is acceptable when the number of kitchen personnel is less than six.
NOTE: Where mess halls are detached from barracks, one shower will be provided for six to twenty persons and two showers for more than twenty persons. A vestibule will be provided between toilet rooms and the kitchen.

(7) Clothes washers and automatic dryers. "Rough-in" will be provided for future installation of washers and dryers in male and female barracks and male bachelor officers' quarters. Washers and dryers furnished by the Government will be installed in female barracks and female bachelor officers' quarters. Space allocation will be based on the following quantities:
Male barracks and male bachelor officers' quarters:
1 washer for each 50 to 60 persons
1 dryer for each 50 to 60 persons
Female barracks and female bachelor officers' quarters:
1 washer for first 25 persons; 1 dryer for each group of two washers
2 washers for the first 50 persons; 1 washer additional for each added 50 to 60 persons

in an earlier discussion, but remember that finding discrepancies in this area is not unusual in an environmental sanitation inspection. The most frequent problems result from inadequate cleaning, indiscriminate storage of personal food items, and improper disposal of food wastes, leading to insect and rodent attraction and harborage.

Exercises (404):

1. List the common requirements for existing base facilities.

2. What frequent sanitation problems result in insect and rodent infestation in public facilities?

405. Review the medical aspects of environmental surveys associated with specific base facilities.

Thus far, our discussion has covered those items common to any facility. However, some facilities — because of their special mission — have special problems. Usually, standards set forth in special directives govern their operation. Since your background and experience will cover inspections of these special facilities, we will limit our discussion to unusual circumstances or items often overlooked in a routine survey.

Barber and Beauty Shops. Several recent innovations in the barbering and beauticians' trade have improved shop sanitation. However, with all the modern automatic devices for maintaining cleanliness and order, human operators, janitors, and maintenance personnel must still operate, clean, and maintain the shop and the equipment. Initial and followup surveys serve to determine the physical acceptability of these establishments. During these surveys, lighting, heat and ventilation, plumbing, and spacing can be determined. The cleanliness and health of workers and their hygiene practices are the routine problem areas where discrepancies continue to occur. The following list of common discrepancies will aid you in inspecting barber or beauty shops: (for further information see AFR 161-34. *Barber and Beauty Shops.*)

a. Dirty disinfecting solution containing hair clippings.

b. Common neck dusters and natural hair bristle brushes being used.

c. Instruments not thoroughly cleaned or properly disinfected. (A period of 15 minutes is necessary for proper disinfection of instruments regardless of the method used.)

d. Unwashed instruments placed in disinfection solution.

e. Dirty razor strop being used for stropping razors.

f. Outer coats or uniforms not worn by barbers or beauticians.

g. Expired health certificates of barbers or beauticians.

h. Interiors of hair dryers dirty.

i. Operators not washing hands between patrons.

j. Operators failing to review requirements of AFR 161-34.

k. Operators working while ill with a communicable disease. The above list is by no means all that should be included in a barber or beauty shop inspection, but it represents some of the most frequent and often overlooked discrepancies.

On-base Housing. You usually inspect barracks, BOQs, and other living areas less frequently than other base facilities in environmental sanitation surveys. Frequent routine inspections by medical services are not necessary except under unusual circumstances. Reports of medical inspections are most useful to commanders to reinforce work order requests for maintenance or repair work on plumbing, screening, or other items creating a health hazard. Occupants often need an explanation or an education as to why certain requirements exist. They may not realize that their cockroach problem is being compounded by half-eaten candy bars, or trash cans filled with empty beverage containers. Other discrepancies include using deodorant cakes in latrines to mask odors caused by improper cleaning, improper storage of wet mops, failure to clean mops, brooms, and other cleaning gear after use, and failure to keep trash receptacles covered. Any of these alone, or coupled with inadequate screening, plumbing malfunctions, improper ventilation, or similar problems, may contribute to increasing the incidence of communicable diseases.

In addition to barracks, there may be onbase trailer parks at your base. Your concern with trailer courts differs from your concern with other living areas. Only the grounds, utility connections, trash collection areas, insects and rodent control, and service buildings are within your jurisdiction to routinely inspect. You can enter the privately owned trailer or yard space surrounding the trailer only by invitation or request of the owner, or under very unusual circumstances. Even then, inspections should be performed by a team of not less than two inspectors and with the knowledge and approval of the hospital and base commanders. With these points in mind, use the following standards in a trailer park inspection or survey:

a. The trailer court location shoudl provide level, well-drained yards; be accessible to good roads; convenient to utilities; and located away from swamps, marshes, insect breeding areas, or heavy industrial zones with objectionable odors or noise.

b. Each space should be at least 1500 square feet with a minimum of 15 feet between each trailer and should have clearly defined boundaries. Additional parking space for at least one motor vehicle is necessary.

c. A minimum of one service building for each 20 trailers is necessary. The building must include not less than two flush-type water closets for women and one water closet and one urinal for men and one laundry tray, one slop sink, two lavatories, and a shower with a hot and cold running water for each sex. When they are located in the same building, toilet facilities for men and women should be separated be a sound-resistant wall.

d. Laundry facilities and adequate drying space should be provided for every 20 trailers.

e. Trailer courts must be supplied with an approved water supply, under pressure, capable of supplying 125 gallons per trailer per day. Water supplies must conform to standards for potable water and must be examined periodically for bacteriological quality. Individual connections must be at least ¾-inch valved outlets, terminating on a riser at least 4 inches above the ground.

f. A vertical drain pipe at least 3 inches in diameter, equipped with a suitable trap below the frost line should be provided at each trailer site. The connections should be insect and rodent proof, protected by a concrete collar 3 inches deep, extending 12 inches from the connection in all directions, and always covered when not in use. The connection should make a watertight junction with the trailer outlet and discharge into an approved sewerage system.

g. Garbage, trash, and other refuse should be stored in leakproof cans with tight-fitting lids. Garbage should be separated from trash and other refuse and stored in a separate container. Cans should be placed on platforms at least 4 inches off the ground, near a service drive.

h. Harborage for rodents or hosts of insect vectors must be eliminated. Breeding places for flies, mosquitoes, and other insects must be eliminated or effectively treated to maintain insect and rodent control.

Keep these standards in mind when you develop a trailer court inspection checklist to use as a guide when performing your inspections.

Day Nurseries and Child Care Centers. These nurseries and centers are important potential sources for the spread of many communicable diseases, especially seasonal illnesses, respiratory infections, fecally spread diseases, and childhood diseases. Several factors contribute to this problem. Many of the children are too young to say when they are ill, and most of the diseases are spread before symptoms appear. The demand for day care may exceed the facility's capacity, encouraging overcrowding to meet the consumer demand. Some facilities are obsolete and rundown and are attended by too few and/or inexperienced persons. Under these conditions, it is easy to understand how nurseries could become a source for or significantly contribute to the spread of an explosive epidemic. The following recommended health practices within day care centers are suggested as a guide but are not necessarily applicable to all day care facilities.

A minimum of 35 square feet of usable floor space per child is a standard requirement. Children should be grouped according to age following the guidelines of AFR 215–27, *Child Development Program.* There should be an isolation room for any child who becomes ill after admission to the center. Isolation of the sick child helps to prevent the spread of infection to the entire group and helps to protect the sick child from undetected infections from other children.

Between 50 and 100 square feet of space per child is required for outdoor play but should not exceed the limits within which the staff can adequately supervise children. Fencing is required. Garbage and refuse containers should remain covered and kept out of reach of children.

Bathroom facilities should be located in or near the playrooms. In new facilities, at least one splitseat, flush toilet and one hand-washing facility is required for every 12 children. Separate bathroom facilities are important for the isolation room and should be adjoining the room.

Kitchens or dining areas should be provided as separate units if children remain for meals. Inspect these facilities as you would any food service facility on base. Kitchens are not to be used as play areas and the presence of children should be controlled. Dishes and detergents should be stored out of the childrens' reach.

Staff members are required to be in good physical health, free from communicable disease, and have appropriate immunizations. Preemployment and periodic physical examination requirements are developed at each base to meet local needs. Annual tuberculin tests or a chest X-ray are required by AFR 215–27. Other examination requirements are determined by the DBMS and are dictated by the duties of the staff member; e.g., handling foods, changing diapers, etc.

The staff should be adequate to maintain constant supervision over all children accepted. Required child-to-staff ratios and required age grouping and group sizes are all outlined in AFR 215–27.

A child care center advisory board must be established by the Base Commander. This board should consist of the center manager, an environmental health representative, a doctor (pediatrician), civil engineering and safety representatives, and a dietitian if meals are served. This group is responsible to set standards, advise on policy, and provide in-service instruction.

Prior to the child being admitted to the child care center the parent must provide current certificates of medical examination and documented proof of age-appropriate immunizations. Reexamination should be mandatory upon recommendation of the staff, if indicated by the child's general condition. Each child should be screened daily for symptoms and signs of illness before the parent or guardian departs and before the child is allowed to join the group. A child observed to have signs or symptoms of illness after admission must be excluded from the group and isolated until called for by the parent or guardian.

The parents or guardians should be required to leave a telephone number where they can be reached immediately in case of an emergency. They should also accept the responsibility for calling for the child promptly upon notification of an emergency. The center should be responsible for notifying the parents whenever a communicable disease has been introduced into the facility. In like manner, parents should notify the center whenever their children have been exposed outside the center. A medical officer should also be readily available for consultation.

Additional Child Care Center requirements are contained in AFR 161-37, *Hygiene and Safety in Child Care Centers*; AFR 215-27, *Child Development Program*; and AFP 215-37, *Air Force Infant Care Guide*.

Laundry Sanitation. Establishments for washing clothes range from genuine hand laundries, where open tubs are used, to highly mechanized plants where workers do little more than tend machinery. You will encounter varied sanitation problems throughout the entire process, from the delivery of contaminated clothing to the finished product.

Listed below are sanitation standards which every laundry plan should meet.

a. Maintain laundry premises in a sanitary condition, free from infestation by insects and rodents. Direct operations towards prevention or elimination of all health hazards.

b. Clean floors daily by a dustless method. Place grease-drip pans where necessary and clean them daily. Provide covered containers for trash. Remove lint from walls, rafters, and ledges periodically.

c. Ventilate workrooms properly at all times during occupancy. Remove excess heat, humidity, toxic chemical vapors, or other atmospheric contaminants with adequate exhaust systems. Either dilution or local exhaust ventilation (LEV) systems may be used. (See fig. 1-2 for an illustration of the principle of ventilation used by either system). Dilution ventilation is used to dilute a contaminant into the surrounding air; LEV is used to remove the contaminant from the air. A complete change of air every 2 minutes is necessary. Adequate lighting in the range of 30 to 50 foot-candles is required.

d. Adequate plumbing fixtures, properly installed, should conform to minimum standards. Maintain them in good repair and keep them in a sanitary condition. Such equipment as automatic washers should discharge into properly trapped sewer connections. Display a sign stating "Wash Hands Before Leaving" in all toilet areas.

e. Provide adequate drinking water in a convenient location.

f. Prohibit eating and cooking in rooms where clothing is handled, sorted, marked, or washed. If meals or lunches are eaten on the premises, provide a separate room or space, properly partitioned, for this purpose.

g. Provide adequate locker space for storage of employees' clothing.

Standards for employees are also important in the laundry sanitation program. Those working in processing areas should wear clean, washable outer garments instead of street clothes. They should be clean in their personal habits and free from communicable disease. Preemployment and periodic physical examinations should be required, to include any tests of examinations deemed necessary by the DBMS. Other personal hygiene habits must include hand washing before work, after each visit to the toilet, and after handling soiled or contaminated articles.

All articles must be treated by a process which includes exposure to hot wash water containing alkalines or detergents and chemical disinfecting agents, followed by physical cleaning and terminated with a series of rinses. If hot water is unavailable or the nature of the fabric prohibits the use of hot water, a suitable germicidal treatment is required. Adequate rinses are necessary to insure the removal of germicidal agents after treatment.

Areas for the receiving and handling of soiled and contaminated articles should be separate from the area designated for handling and issuing finished products. Vehicles and containers used for transportation and storage of laundry should be kept clean and sanitary. Other safety measures and practices should conform to the standards discussed in Volume 2 of this course.

It would be beneficial in your surveys to have a checklist which includes all the items you wish to cover. Such a checklist can be valuable as a training aid in OJT instruction of other environmental health specialists and help insure that standardized surveys are done.

Extra-Military Sanitation. In the continental United States, inspection of areas or establishments located outside military jurisdiction are not normally routine for environmental medicine specialists. However, occasions may arise which will require you to perform such inspections or surveys. In most instances, the aid of local public health officials should be solicited. Examples of such occasions might be a gross infestation of insects or rodents caused by breeding areas adjacent to the base; a food poisoning outbreak; sexually transmitted disease (STD) contact reports indicating an establishment in a nearby community is sheltering or encouraging prostitutes or call girls; or the owner or manager of an "off limits" establishment seeking approval for military trade. Though the owner would make a formal request through the base commander, the DBMS must give approval for the inspection. You must handle each problem individually; no standard rules can govern all situations.

You may serve an entire tour of duty without performing an extra-military sanitation inspection, but you are subject to, and may be called upon to perform such a survey or inspection at any time. If the situation arises, govern yourself according to the type of inspection needed, the local governing policies of your command, the desires of the commander and DBMS, and the local health authorities. In this, perhaps more than in any other facet of your job, diplomacy will determine the success of the survey or inspection and produce a result that is satisfactory to all concerned. Good community relations between military and civilian public health personnel are important to the health and well-being of the community.

Overseas situations more often require us to do a variety of extra-military sanitation inspections. If tact and diplomacy are important in stateside situations, they are undoubtedly of primary concern in an area where your actions or attitudes, good or bad, may be magnified by the political climate to reflect Americanism or affect international relations.

Exercises (405):

1. What is the purpose of initial and followup surveys?

2. In what way are surveys of onbase housing helpful to commanders?

3. In what areas of the base trailer park would you have jurisdiction in performing an environmental survey?

4. What is the primary environmental concern in day nurseries and child care centers?

5. List the recommended members of the Child Care Center Advisory Board.

1-3. Factors of Food Facility Sanitation Evaluations

The art of performing food facility sanitation evaluations centers around three basic talents: the ability to write; the ability to see; the ability to think. People who possess these three abilities can, and do, accomplish sanitation evaluations. These sanitation evaluations are a part of our daily routine as environmental health personnel. We enter food service facilities, observe the behavior and procedures that exist, and document our observations. Sounds a good deal like doing an environmental survey, doesn't it? Doing sanitation evaluations can be one of the most challenging and rewarding experiences you may have in the Air Force.

406. Cite aspects of food facilities that are of significance during sanitation and food service evaluations.

Sanitation Evaluations. The primary purpose of performing evaluations in food service facilities is to control and prevent foodborne illness outbreaks. The knowledge essential to the control of foodborne illnesses is available. The subject was discussed in depth in Volume 2 of this 90850 CDC. Prevention can be obtained by the effective control and application of the following concepts:

a. Human factors.
b. Time and temperature exposure.
c. Sanitary design of equipment and facilities.
d. Cleaning and sanitizing.

As was just mentioned, the purpose of performing sanitation evaluations is to control and prevent foodborne illness outbreaks. The basic medical aspects of this concept are critical to both an understanding of the ways in which the outbreak occurs and the ways in which we, as inspectors, can assist in the control or prevention of outbreaks.

Human factors. People transmit diseases to people. Sound familiar? We know that it takes people to prepare and serve food to other people. Given that factor, you can make the association with the increased potential for contamination of food with pathogenic organisms. Contamination leading to illness can occur any time a person handles food.

Time and temperature exposure. This particular factor is the key to the prevention of foodborne illness outbreaks. The longer a food is allowed to remain at temperatures which aid the growth of pathogenic organisms, the greater is the potential that that food will carry a disease into the population. Cumulative abuses of storage temperature requirements are as dangerous as a single abuse. Cumulative times when a food sits at an unsafe temperature produce the same potential for disease transmission. You must educate the food-handling population in the proper methods of storing foods, as outlined in AFR 163-8. Hot foods must be maintained at 140 °F or below. It sounds simple, and yet the principle is abused constantly.

Sanitary design of equipment and facilities. The design of food service equipment must meet a number of criteria. The operator wants the equipment to be functional and long-lasting. The person who provides the sanitation evaluation wants the equipment to be safe from public health hazards and easy to clean. These same criteria apply to the facility where the food service operations occur. There is a possibility of conflict between the interested parties because the need for functional use may make the desire for ease in cleaning impossible to meet, and so on. It's important that the public health criteria for these two specific subjects be acceptable to both parties because the need to prevent foodborne illness outbreaks requires that the standards be met and not just provide a "window dressing" for the facility operator.

Cleaning and sanitizing. Effective cleaning of equipment in a food service facility reduces the chances for contamination of foods during preparation, processing, storage, or serving. Clean equipment is essential for subsequent sanitizing treatment which further minimizes the transmission of disease organisms to the consumer. Food handlers must understand how important proper cleaning is to the next step in the process, sanitization. You must understand its importance and be capable of educating food service personnel in the principles and methods of good cleaning and sanitizing. AFR 163-8, *Control of Foodborne Disease*, outlines the basic standards of sanitation required for military and civilian-run food service operations. You should read this regulation and become familiar with it.

Food Service Evaluations. Facilities that operate under direction of Food Services use appropriated funds to purchase subsistence (food items) for the feeding of military personnel. Air Force Food Services operate the base dining halls, alert and in-flight kitchens, and any other food operation that is directed and supplied by the staff of the base Food Services. Facilities operated by the Army and Air Force Exchange Service (AAFES) use nonappropriated funds for the same purpose. Morale, Welfare, and Recreation (MWR) facilities also use nonappropriated funds and usually operate such facilities as the Officers Open Mess and the NCO Open Mess. The primary purpose of these operations is the feeding of military personnel. These facilities are charged with the responsibility of providing nutritional meals to military members — to maintain the health and morale of the military population — while observing the safety, health, and financial guidelines established by the Air Force. It's not an easy job; you should keep that in mind whenever you're evaluating a food operation.

Food service operations involve active duty personnel as well as contracted food service employees. Each type of food service worker must be approached and educated in a particular manner — one which will gain their individual attention — so that the importance of sanitation in their work is stressed in a way they'll understand and apply.

When you perform a sanitary evaluation you have certain areas of concern which you'll want to observe. AFR 163-8 and AF Form 977, *Food Facility Sanitation Checklist*, are your basic guides for evaluating a food service facility. Some of the most critical areas to evaluate can be compared to those concepts of prevention and control we mentioned earlier — human factors, time and temperature exposure, sanitary design of equipment and facilities, and cleaning and sanitizing.

Human factors. This area of concern in the sanitation evaluation is addressed by AFR 163-8 in Chapters 1 and 3. In Chapter 1 we are given the criteria for the application of the term food handler — who is a food handler and who isn't — so that the evaluator and the manager of the facility know exactly who must meet the personal hygiene, medical examination, and training requirements established by AFR 163-8. Any person who works where unsealed food or drink is handled, processed, prepared, or served and who touches food or a food contact surface in any way is a food handler. The exception to the rule involves vending machine service people, club and commissary managers and supervisors, and others who work where food is prepared but don't actually contact the food or food contact surfaces.

In addition to defining who is and isn't a food handler, AFR 163-8 sets personal hygiene requirements for personnel who work in food service facilities. Chapter 3 tells us that food handlers must be examined by their supervisor daily for signs of illness or infectious injury (infected sores, scratches, acne pimples, etc.) as well as for adherence to personal hygiene standards which include:

a. Wearing clean, light-colored clothing.

b. Cutting fingernails short and keeping them clean.

c. Keeping facial hair clean and neatly trimmed to 1 inch or less.

d. Keeping heads covered with either a hat or hairnet.

e. Removing all jewelry except wedding and engagement rings.

f. Keeping hands and exposed portions of arms clean at all times.

Food handlers must report to the medical facility whenever they are experiencing symptoms of illness or have sustained any injury while on the job. Remind food handlers that this is their personal responsibility and that they need to identify themselves as food handlers to the medical personnel they encounter in the medical facility.

Food handlers are required to obtain a medical examination and attend medical training before they actually being work as a food handler. Remember the definition of a food handler? If an individual wishes to obtain a food-handling job in a facility and is working as a janitor in that facility already, the physical examination and the initial food-handler training must be completed before any food-handler duties are performed.

Medical examinations are performed prior to employment at periodic intervals established by the Director of Base Medical Services (DBMS), and whenever the food handler has been away from work for an extended period. The DBMS sets the medical examination criteria for this type of examination. The examinations are done by the Physical Examination and Standardization Section (PES) of the Flight Surgeon's Office. DD Form 2013, Medical Certificate, is issued when the examination is successfully completed, signed by the examining physician, and sent with the employee back to the place of employment. This card must be kept on file in a location where you, as the medical evaluator, can insure that the individuals assigned to the specific food operation have current medical examinations.

Training of food handlers is conducted by the Environmental Health Office. Training requirements are outlined in Chapter 3 of AFR 163-8. There are three training programs. (1) Preemployment (or initial) which is required for everyone who wants to become a food handler; (2) annual training which is required for all food handlers (personnel who have completed initial training must attend annual training within 90 days of that completion date); and (3) supervisory training which is offered once each year to food service supervisors at your base. Successful completion of the program offered to preemployment personnel is certified by issuing AF Form 1216, Food Handler Training Certificate, in duplicate. The original goes with the employee back to the facility where it is filed with the DD Form 2013. The duplicate stays in your office file to monitor who is required to attend further training, either annual or supervisory. Whenever any further training is received, the employee must bring the AF Form 1216 to the training session(s) to be signed by the trainer upon successful completion.

Time and temperature exposure. Chapter 2 of AFR 163-8 covers the time and temperature relationship we discussed earlier. This chapter presents specific guidelines for the care of foods in hopes of controlling and preventing foodborne illness. Hot foods must be held at 140° F or above while being served or stored hot. The only exception to the rule involves rare roast beef and rare beef steak which must be heated to 130 °F. Maintain chilled foods at 45 °F, or below, during service or storage. There are no exceptions. Maintain frozen foods at 0 °F during storage. A maximum of 10 °F is authorized for 7 days immediately before use.

Read this portion of AFR 163-8 carefully. The guidelines for handling foods, storing foods, and preparing and serving foods must be observed by food service personnel. Control and prevention of foodborne illness depend upon it.

Sanitary design of equipment and facilities. The material, design, construction, and state of repair are all of sanitary importance when evaluating food service equipment and facilities. Equipment made from materials that are difficult to clean, such as wood, are not likely to be cleaned as thoroughly as necessary. Facilities that have been allowed to fall into a poor state of repair cannot maintain the conditions of sanitary protection needed to protect consumers from potential illness.

The National Sanitation Foundation (NSF) develops standards for the design and construction of food service equipment. AFM 88-15, *Air Force Design Manual — Criteria and Standards for Air Force Construction*, and AFR 163-8 set construction standards for food service facilities. The Air Force is not presently purchasing any food service equipment whose design has not been approved by the NSF. Keep in mind that older facilities are harder to modify to meet up-to-date sanitary standards. Common sense and reason will dictate the best course of action when faced with a sanitary problem in older food service facilities.

Cleaning and sanitizing. A clean and sanitary establishment is the result of a planned program, properly supervised and on schedule. However, when the going gets rough during the rush hour and workers are trying to meet the needs of the customers, correct practices are often neglected. Only a manager who is knowledgeable and alert can prevent these breakdowns in good sanitation discipline. The manager must know how a cleaning/sanitizing job should be done, instruct workers accordingly, and then see to it that instructions are carried out.

The concepts of "clean"and "sanitary" have already been explained, but the distinction between the two is worth repeating because of their importance to cleaning and sanitizing operations. Cleaning is the removal of matter from a surface when it does not belong. Sanitizing is the reduction of the number of disease-causing and other organisms to safe levels. The materials and procedures used in these two processes are not identical.

Cleaning and sanitizing form the basis of good housekeeping and together result in this fundamental sanitation rule: All customer-contact or food-contact surfaces must be cleaned and sanitized after every use. This rule applies not only to tableware, pots and pans, and cooking utensils but also to stationary equipment used in the preparation of food or for the benefit of customers, and even to equipment used in cleaning other equipment. All surfaces coming into contact with food (whether plates, pots, or potato peelers) must be cleaned and sanitized after each use, after any interruption of service during which they may have become contaminated, or at regularly scheduled intervals if they are in constant use. The same rule applies to all instruments used in barbering and cosmetology. Razors, scissors, combs, and tweezers are good examples. Effective cleaning is a lot more complicated than the simple combination of soap, water, and elbow grease.

Cleaning takes place when a cleaning agent contacts a soiled surface under sufficient pressure and for a long enough time to penetrate the soil and remove it. Many cleaning agents are designed to be dissolved in water, while others, such as powders used for the dry cleaning of some floors, are meant to be used "as is."

Exercises (406):

1. List the basic factors of a food facility sanitation evaluation.

2. Why are people so important in foodborne disease transmission?

3. What is the number one cause of foodborne illness outbreaks?

4. List the criteria of needs applied to equipment by the food service operator.

5. List the criteria of needs applied to equipment by the public health evaluator.

6. Why is effective cleaning important in a food service facility?

7. Name the publication that outlines sanitation standards for military and civilian-run food service operations at base level.

8. Identify the food service agencies that operate using appropriated funds and those that use nonappropriated funds.

9. What responsibilities do food service operations on military bases have towards the consumer?

10. What are the basic guides for evaluating a food service facility?

11. Define the term "food handler."

12. What must food handlers do when they are ill or injured?

13. List the prerequisites set by the Air Force for becoming a food handler.

14. What agency determines food service equipment approval for the Air Force?

15. Where would you find construction criteria for military food service facilities?

407. Cite specific variables in the cleaning process that affect sanitation.

Variables in the Cleaning Process. Many variables affect the outcome of the cleaning process. These variables should be taken into account before the process is started.

a. Type and condition of soil. Soils and stains can be classified as protein-based (blood, egg); grease or oil-type (margarine, animal fat); and acid or alkaline (tea, dust, perspiration). In addition, the condition of the soil — fresh, ground-in, soft, dried, or baked on — affects the ease of removal.

b. Type and temperature of water. If water is used as part of the cleaning process, it must, of course, be potable. Dirty water limits the effectiveness of the cleaning agent. The amount of mineral impurities in the water also affects cleaning properties. Some detergents are formulated for use in hard-water areas, while other detergents may be made ineffective by hard water.

In general, the higher the temperature of the water in which the cleaning agent is dissolved, the faster the chemical reaction, and the more effective the cleaning action. The exceptions to this rule, of course, are cleaning agents specifically designed to be used in cold water.

C. Surface being cleaned. The surface may be hard or soft, easily damaged of corrosion resistant. Different surfaces demand varying cleaning agents.

d. Type of cleaning agent. Soap, for example, may leave a grease film under certain conditions; abrasives may scratch some surfaces. A mildly alkaline cleaner may be used for washing painted walls, while a strongly alkaline cleaner would be used for heavily soiled concrete floors.

e. Pressure to be applied. In many cleaning operations, pressure consists primarily of "elbow grease" or the friction from a hand-held brush or other cleaning implement. The purpose of pressure is simply to remove the loosened soil from the surface of the object. Obviously, the amount of pressure will affect the outcome. Other sources of pressure include the spray action in mechanical dishwashers, and the turbulence created when water is forced through equipment with clean-in-place systems.

f. Duration of treatment. All other factors being equal, cleaning effectiveness increases with the time of exposure to the cleaning agent. The role of a cleaning agent is to loosen soil from the surface of the object being cleaned and keep it "suspended" so that it is not redeposited on the item. Broadly defined, a cleaning agent is anything — steam, water, soap, or sand — that removes soil. Ordinarily, however, the word refers to chemical compounds specifically formulated for special cleaning purposes — use on floors, in dishwashing machines, for removing mineral deposits, for cleaning barbers scissors, and so on.

A particular cleaning agent should be selected for its special cleaning properties. A compound that is powerful in one application may prove totally ineffective in another. In addition to being effective and compatible with its intended use, a cleaning agent should fit the needs of the facility. It must be stable while being used, noncorrosive, nontoxic or safe when applied as directed, and economical.

Sanitization. After a surface has been thoroughly cleaned, it must be sanitized. In many cases, such as food-contact surfaces, hospital surfaces, and child care centers, sanitization is essential. The term "sanitized," you will recall, means that the microbial contamination of an object or surface has been reduced to a safe level. It is a step above "clean" — which is merely the absence of soil — but a step below "sterile" — which is the absence of all living organisms.

A conscientious manager may wonder, "Why don't we just sterilize everything and be on the safe side?" The answer is that sterilization would be quite expensive; it is not necessary.

At the other extreme, the worker may mutter, "Why do I have to sanitize this pot? We're just going to cook in it, and the heat from the cooking process will kill the bacteria." There is no guarantee that the heat involved in cooking will heat all parts of the item to a high enough temperature for a long enough time to effectively sanitize it. Also, there is no assurance that the pot will be used for cooking at all. It may be used for mixing where no heat treatment is involved.

Sanitization can be accomplished in two ways: the object may be heated to a temperature high enough to kill micro-organisms; or it can be treated with a chemical sanitizing compound. In either case, the object must be thoroughly cleaned and completely rinsed in order for the sanitizing process to work. Caked-on soils not removed by cleaning, for example, may shield bacteria from a sanitizing solution. Sanitization, in short, is no substitute for good cleaning.

Exposing a clean object to sufficiently high heat for a sufficiently long time will sanitize it. The higher the heat, the shorter the time required to kill harmful organisms.

The most common method of heat sanitizing in a food service facility is immersion of an object in water at 170 °F (about 77 °C) for no less than 30 seconds. Water must be kept hot enough and an accurate thermometer must be mounted at the outlet of the system. For clean-in-place applications, the hot water should run through the machine for as long a time as the manufacturer's operating manual recommends.

Still another means of heat sanitization is through the use of live steam. This method may be used on equipment that is too large to be immersed, provided that the equipment is capable of confining the steam. It is important to note, however, that the temperature at the surface of the object being sanitized is what counts, not the temperature of the steam in the line. Water or steam may be quite hot when it leaves its source but will cool very quickly when contacting a cool object.

Sanitizing can be achieved through the use of chemical compounds capable of destroying disease-causing microorganisms. Chemical sanitizers have found wide acceptance. They are rigorously regulated by the U.S. Environmental Protection Agency (EPA), which registers them as pesticides. Consequently, any product that uses the word "sanitize" on its label and bears an EPA registration number will, if used as directed, reduce micro-organisms to levels acceptable to most local regulatory agencies.

EPA labeling requirements are quite strict, so you can count on the information on the label of the sanitizer you purchase to be accurate and complete. This information will include a list of active ingredients; directions for how, where, and when to apply the product; what concentrations to use; data on minimum effectiveness; and warnings of possible health hazards.

Chemical sanitizing is done in two ways: by immersing an object in the correct concentration of sanitizer for 1 minute; or by rinsing, swabbing, or spraying double the usual recommended concentration of sanitizer on the surface to be sanitized..

The strength of the sanitizing solution must be tested frequently since the sanitizing agent is depleted in the process. The solution must be changed when it is no longer effective. Test kits are usually provided free of charge by the sanitizer manufacturer for this purpose.

Some sanitizing agents are toxic to humans as well as to micro-organisms; they, therefore, are acceptable for use only on non-food-contact surfaces. Others may not be toxic, but they impart undesirable flavors and odors and are unfit for food service use. Make certain that sanitizers in this category aren't selected for use in food service facilities.

Three of the most common chemicals used in sanitizing are chlorine, iodine, and quaternary ammonia (quats). The properties of these agents differ somewhat.

Chlorine and iodine compounds have some properties in common. They will kill most bacteria if used correctly, are not greatly affected by water hardness, and lose effectiveness in water that is too alkaline. Because of this last factor, it is necessary to apply a thorough rinse to items that have been cleaned with general-purpose or heavy-duty detergents, which are usually alkaline, before applying the sanitizers.

There are also some differences between chlorine and iodine compounds. Iodine compounds (iodophors) have a built-in indicator of concentration — the stronger the solution, the deeper its amber color. Chlorine compounds are more likely than iodophors to be harmful to the skin and to attack metal.

Quats are relatively noncorrosive and are effective in both acid and alkaline solutions. The bacteria-killing power of a particular quaternary ammonia compound may be limited, but a blend of quat compounds can dispatch a great variety of micro-organisms. A high degree of water hardness (over 200 parts per million) will make some quats less effective. Since quaternary ammonia compounds are manufactured according to many different formulas, read the label to make sure that the particular formula in question suits the sanitizing needs for your operation.

Figure 1-4 summarizes the properties of chlorine, iodine, and quaternary ammonia sanitizers. As the exhibit indicates, concentrations necessary to kill bacteria are higher for clean-in-place and power spray applications than for the immersion method. Temperature ranges are also important in effecting sanitization. The solution must be warm enough — at least 75 °F (about 24 °F — to allow chemical reactions to take place. But if temperatures are over 120 °F (about 49 °C), chlorine and iodine sanitizers may leave the solution.

Some sanitizers are blended with detergents to make detergent-sanitizers. These products will sanitize effectively, but sanitization still must be a separate step from cleaning. The removal of all organic soils from a surface is the only way in which adequate sanitation can be guaranteed. Remember, organic soils often nullify the sanitizing effect of chemicals, and these specific combination products are no different. Regular cleaning and sanitizing of equipment, utensils, and work or serving surfaces reduce the possibility of food contamination and transmission of disease organisms to the population. Thorough cleaning not only removes obvious soil but also prevents the accumulation of food particles that may support the growth of food poisoning organisms. While cleaning removes the visible soil, sanitizing reduces the unseen micro-organisms that may be present on tableware such as cups, glasses, bowls, plates, and flatware.

In barber and beauty shops, cleaning and sanitizing instruments also relates to the control of unseen micro-organisms. Razors, scissors, combs, tweezers, and other tools must be washed thoroughly with soap and hot water (170 °F) to remove film and debris (skin oils, hair, scalp flakes, etc.). These tools can be dried using a clean

	Chlorine	*Iodine*	*Quaternary Ammonia*
Minimum concentration			
—for immersion	50 parts per million (ppm)	12.5 ppm	200 ppm
—for power spray or cleaning in place	100 ppm	25 ppm	400 ppm
Temperature of solution	75°F/24°C+	75–120°F 24–49°C Iodine will leave solution at 120°F. Iodine is also relatively effective in cold water.	75°F/24°C+
Time for sanitizing			
—for immersion	1 minute	1 minute	1 minute; however, some products require longer contact time; read label.
—for power spray or cleaning in place	Follow manufacturer's instructions.	Follow manufacturer's instructions.	Follow manufacturer's instructions.
pH (detergent residue raises pH of solution)	Must be below pH 10.	Must be below pH 5.5.	Most effective around pH 7 but varies with compound.
Corrosiveness	Highly corrosive to some substances.	Slightly corrosive.	Not corrosive.
Response to organic contaminants in water	Quickly inactivated.	Made less effective.	Not affected.
Response to hard water	Not affected.	Not affected.	Some compounds inactivated but varies with formulation; read label.
Indication of strength of solution	Test kit required.	Amber color indicates effective solution, but test kits must also be used.	No reliable test for active agent remaining in solution. Follow label instructions closely.

Figure 1-4 Properties of chemical sanitizing agents.

towel or clean disposable tissue. If a brush is used to remove hair from these tools, it must be a stiff bristle brush used solely for that purpose.

If a patron is suspected of harboring a communicable disease or infection, clipper heads and other metallic instruments (including instruments used in pedicure and manicure) must be disinfected or sanitized at once after each use. The common sanitization procedure is:

(1) Soaking in a 10 percent standard compound Lysol or creosol solution, or a 4 percent formaldehyde solution, for 15 minutes. These sanitizing solutions must be prepared daily, as needed.

(2) Rinsing in running potable water after soaking to remove the chemical sanitizer, and drying with a clean towel or clean disposable tissue prior to use.

Manual cleaning and sanitizing. The first requirement for cleaning and sanitizing most portable food-contact items is a washing area away from the food-preparation area. This work station should be equipped with at least three sinks, separate drainboards for clean and for soiled items, and an area for scraping and rinsing food soil into a garbage container or disposal. (See fig. 1-5). In a few areas, two-sink units are permitted for manual cleaning and sanitizing.

If hot water will be used to sanitize, the third compartment of the sink must be equipped with a heating unit to maintain water at the desired 170 °F. A thermometer also must be mounted in the sink to accurately indicate the temperature. A clock with a second hand should be easily visible so that washers do not have to estimate the time of immersion. You also will need long-handled tongs, hooks, and baskets or racks which can be used to dip clean items into the sanitizing bath of hot water or chemical sanitizer so that they need not be handled.

Requirements for cleaning and sanitizing equipment vary from locality to locality, so you should check regulations as they apply in your area. Whatever the item, manual cleaning and sanitizing involves the same six steps:

(1) Clean the sinks and the work surfaces before each use.

(2) Presoak and scrape items to be cleaned to remove gross food soil that may deactivate the detergent. This step should be done on a scraping table or other area where garbage can be disposed of without contaminating clean equipment and utensils. Items to be cleaned should be sorted; silverware should be presoaked in a solution designed for that purpose.

(3) Wash in the first sink in a clean detergent solution at about 120 °F using a brush or dishmop to loosen and remove any remaining soil.

(4) Rinse in a second sink in clear, potable water at about 120 °F to 140 °F to remove all traces of food soil and detergent that may interfere with the operation of the sanitizing agent.

(5) Sanitize in the third sink by immersing items in hot water at 170 °F for 30 seconds or in a chemical sanitizer solution for 1 minute. If a chemical sanitizer is used, a good practice is to mix the sanitizing solution initially in twice the recommended strength for immersion. The water carried over from the rinse sink won't dilute the sanitizing solution below the minimum concentration required for effectiveness. Be sure that all surfaces contact the sanitizing chemical or water for the prescribed length of time — in particular, be aware of air bubbles inside inverted containers that might shield the interior from the sanitizer.

(6) Air dry. Do not wipe dry. Wiping can recontaminate all the newly sanitized utensils and equipment.

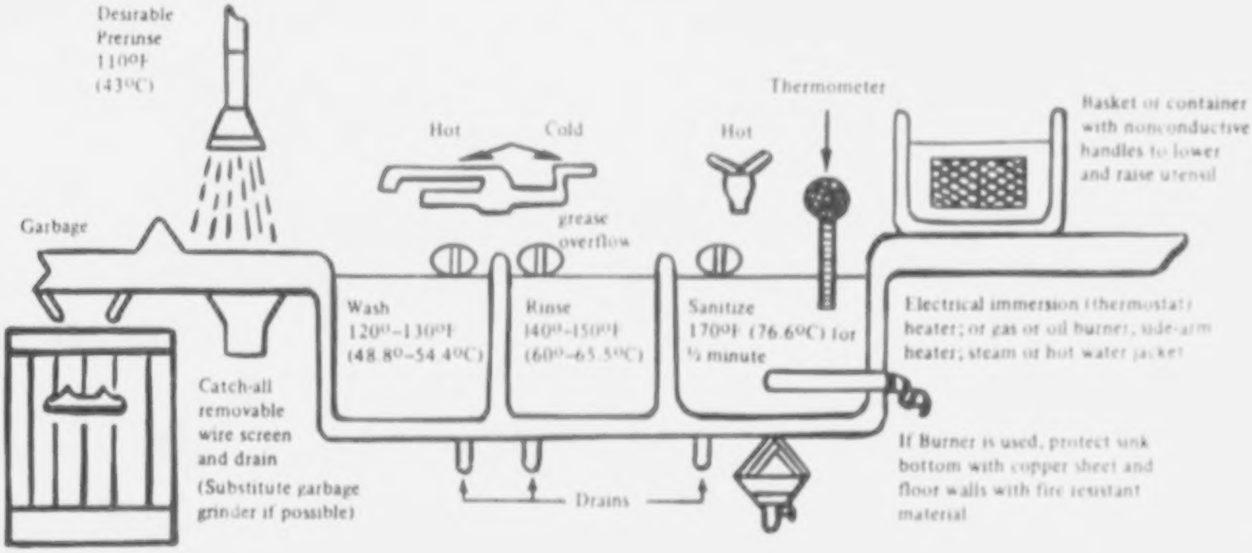
Desirable Prerinse 110°F (43°C)
Thermometer
Hot
Cold
Hot
Basket or container with nonconductive handles to lower and raise utensil
Garbage
grease overflow
Wash 120°-130°F (48.8°-54.4°C)
Rinse 140°-150°F (60°-65.5°C)
Sanitize 170°F (76.6°C) for ½ minute
Electrical immersion (thermostat) heater; or gas or oil burner, side-arm heater; steam or hot water jacket
Catch-all removable wire screen and drain
(Substitute garbage grinder if possible)
Drains
If Burner is used, protect sink bottom with copper sheet and floor walls with fire resistant material

Figure 1-5 Manual cleaning and sanitizing operation.

Cleaning and sanitizing stationary equipment. Stationary food preparation equipment should come with the manufacturer's instructions for disassembly and cleaning. Follow these instructions if they are available. For general equipment cleaning, unplug the unit if it is electrically powered. Remove whatever parts you can, and wash and sanitize them as described in the previous section. Wash remaining food-contact surfaces and rinse with a solution of chemical sanitizer mixed to twice the strength required for immersion sanitizing. Wipe down the non-food-contact surfaces and allow all parts to air dry before reassembling.

Cloths used for wiping down stationary equipment and other surfaces should be wrung out frequently in a sanitizing solution, stored in the solution when not in use, and laundered daily or more often if necessary. Cloths used for food-contact surfaces should be kept separate from other wiping cloths.

Some stationary items are designed to have detergent and sanitizing solutions pumped through them. For these items that are equipped for cleaning in place, consult the manufacturer's instructions. Equipment also can be cleaned and sanitized through the use of power-spray equipment. To sanitize in this way, the object must be sprayed for 2 to 3 minutes with a double-strength solution of the sanitizer.

Sanitizing wooden cutting boards presents a special problem. Even those which meet public health standards are difficult to sanitize and should certainly be discarded or refinished when they become badly scored by knife blades. If wooden boards must be used, they should be scrubbed with a nontoxic detergent solution and stiff-bristle nylon brush, then rinsed and treated with a sanitizing solution after every use.

Mechanical cleaning and sanitizing. Though essential for some purposes, manual cleaning and sanitizing does have its limitations. Properly operated and maintained, machines can be more reliable in removing soil and micro-organisms from tableware and kitchen implements. Because of this factor and the needs of high-volume operations, the food service industry has moved increasingly to the use of dishwashing machines.

Purchase of dishwashing equipment can represent a sizeable investment, so individual requirements are carefully considered before a decision is made. For a successful machine cleaning and sanitizing program the facility's management will need:

a. A machine that is capable of handling a load of soiled table and kitchen ware, but one that does not have such a large capacity that it must run half empty.

b. Proper installation and regular maintenance to insure that the machine does an adequate job of cleaning and sanitizing.

c. A booster heat of sufficient capacity to supply the machine with water at 180 °F — the required temperature for a hot-water sanitizing rinse by machine. (Note that general purpose hot water heaters as a rule bring the temperature no higher than 140 °F).

d. An efficient layout in the dishwashing area to utilize personnel and machine to best advantage.

e. Workers who know how to operate and maintain the equipment and who are knowledgeable about the correct use of required detergents and other chemicals.

f. Regular inspection of the finished product — the washed and sanitized items — to insure that machine is performing up to par.

g. Regular inspection of the entire operation by management to make certain that correct procedures are being followed.

Dishwashing machines vary widely in size, style, and capabilities. There are stationary machines, in which the rack or items to be washed sits in one place while the machine progresses through wash, rinse, and sanitizing cycles. There are conveyor machines that move the dishes through the various cycles. There are machines in which the dished are racked, and also flight-type machines in which the dishes are placed directly onto conveyors equipped to hold them.

Whatever the type of dishwashing machine, the following requirements should ordinarily be met:

a. Thermometers should be provided indicating the temperature of the water in each tank of the machine and showing the temperature of the final rinse water as it enters the manifold.

b. Dish tables of adequate size should be provided to handle both soiled and cleaned equipment, tableware, and utensils.

c. Unless the machine has a prewash cycle, items to be cleaned must be scraped or soaked to remove food debris before being washed in the machine.

d. In compartmented machines, the rinse water tanks should be protected by some device that prevents the flow of wash water into the rinse water.

e. In conveyor-type machines, conveyor speed should be accurately timed to make sure the items receive proper exposure.

f. Spray-type dishwashing machines should come equipped with some device that allows the operator to check on the pressure of the wash and final rinse water.

g. All dishwashing machines should be cleaned at least once a day or more frequently when the circumstances warrant.

While dishwashing machines can be the most reliable way to clean and sanitize tableware and utensils, they also can be the source of innumerable problems if installed or operated incorrectly. Figure 1-6 summarizes some of these problems, with possible causes and cures.

Storage requirements. Now that all tableware, utensils, and equipment are clean and sanitary, you must be able to keep them that way. The objects must be transported to clean and protected storage areas. Wheeled dish tables or carts, if they are easily maneuverable, provide the best means of transportation in many instances. These dish carts must, of course, be clean and sanitized.

The storage area must be more than 6 inches off the floor and be protected from splash, dust, and contact with food or soil. All items must be accessible without the necessity of touching surfaces that will later contact food or the customer's mouth. For example, glasses and

Symptom	Possible Cause	Suggested Cure
Soiled Dishes	Insufficient detergent.	Use enough detergent in wash water to ensure complete soil removal and suspension.
	Wash water temperature too low.	Keep water temperature within recommended ranges to dissolve food residues and to facilitate heat accumulation (for sanitation).
	Inadequate wash and rinse times.	Allow sufficient time for wash and rinse operations to be effective. (Time should be automatically controlled by timer or by conveyor speed.)
	Improperly cleaned equipment.	Unclog rinse and wash nozzles to maintain proper pressure-spray pattern and flow conditions. Overflow must be open. Keep wash water as clean as possible by prescraping dishes, etc. *Change water in tanks at proper intervals.*
	Racking.	Check to make sure racking or placement is done according to size and type. Silverware should always be presoaked, placed in silver holders without sorting. Avoid masking or shielding.
Films	Water hardness.	Use an external softening process. Use proper detergent to provide internal conditioning. Check temperature of wash and rinse water. Water maintained above recommended temperature ranges may precipitate film.
	Detergent carryover.	Maintain adequate pressure and volume of rinse water, or worn wash jets or improper angle of wash spray might cause wash solution to splash over into final rinse spray.
	Improperly cleaned or rinsed equipment.	Prevent scale buildup in equipment by adopting frequent and adequate cleaning practices. Maintain adequate pressure and volume of water.
Greasy Films	Low pH. Insufficient detergent. Low water temperature. Improperly cleaned equipment.	Maintain adequate alkalinity to saponify greases; check detergent, water temperature. Unclog all wash and rinse nozzles to provide proper spray action. Clogged rinse nozzles may also interfere with wash tank

Figure 1-6. Trouble shooting guide.

Symptom	Possible Cause	Suggested Cure
Greasy Films (cont.)		overflow. Change water in tanks at proper intervals.
Streaking	Alkalinity in the water. Highly dissolved solids in water.	Use an external treatment method to reduce alkalinity. Within reason (up to 300–400 ppm), selection of proper rinse additive will eliminate streaking. Above this range external treatment is required to reduce solids.
	Improperly cleaned or rinsed equipment.	Maintain adequate pressure and volume of rinse water. Alkaline cleaners used for washing must be thoroughly rinsed from dishes.
Spotting	Rinse water hardness.	Provide external or internal softening. Use additional rinse additive.
	Rinse water temperature too high or too low.	Check rinse water temperature. Dishes may be flash drying, or water may be drying on dishes rather than draining off.
	Inadequate time between rinsing and storage.	Allow sufficient time for air drying.
Foaming	Detergent. Dissolved or suspended solids in water.	Change to a low sudsing product. Use an appropriate treatment method to reduce the solid content of the water.
	Food soil.	Adequately remove gross soil before washing. The decomposition of carbohydrates, proteins or fats may cause foaming during the wash cycle. Change water in tanks at proper intervals.
Coffee, tea, metal staining	Improper detergent.	Food dye or metal stains, particularly where plastic dishware is used, normally requires a chlorinated machine washing detergent for proper destaining.
	Improperly cleaned equipment.	Keep all wash sprays and rinse nozzles open. Keep equipment free from deposits of films or materials which could cause foam build-up in future wash cycles.

Figure 1-6. Trouble shooting guide (Cont'd).

cups should be stored inverted.

The food-contact surfaces of fixed equipment also must be covered or otherwise protected when not in use. The wholesomeness of prepared food can and must be safeguarded through sanitary practices in kitchen and storage areas, which includes effective control of food temperatures at all times. In a sanitary food service facility, only clean, safe food is served to the public.

Exercises (407):

1. List the three chemicals commonly used in food service sanitation.

2. Discuss the two ways sanitization may be accomplished.

3. List the specific variables that affect cleaning.

4. How is heat sanitization commonly accomplished?

5. What is the first requirement for cleaning and sanitizing portable food contact items?

6. How is stationary, food-preparation equipment cleaned and sanitized?

1-4. Accomplishing Surveys and Evaluations

We've spent all of our time in this volume discussing the standards, criteria, and guidelines for operating facilities on Air Force installations. You ought to be fairly familiar with some of the basic standards, etc., that are set for these facilities. You've been on base for a few months now and you've seen several of these places; probably eaten in them, too. You have the visual aids necessary to help you in understanding what we've previously discussed. The actual writing of a report, however, may not be a part of your experience as an Environmental Medicine Specialist. Yet, the writing of the report is one of the most critical steps in performing an environmental survey or a food facility sanitation evaluation. The challenge of learning to write in a clear, concise, and informative style is our topic of discussion in this section. If you're willing to study, practice, and objectively critique your own writing, you may very well become a fine writer. You may also become a medical evaluator who can get things done at base level.

408. Identify principles of effective writing.

Communication, the process of transmitting and receiving information, is so fundamental to the practice of management that without it an organization could not exist. If we could not communicate with our fellow workers, our supervisors, our commanders, or associated agencies and commands we could get nothing — absolutely nothing — done. The basic reason for any type of communication is to get some manner of action or behavior. The potential for misunderstanding increases with the number of people required to transmit or receive a given message. Equally, the symbols used to transmit a message can help or hinder its receipt and understanding.

Effective Writing. There are standard principles associated with the art of effective writing. They're short, clear, and to the point.

Plan what to say. Your writing will be clear only if your thinking is clear. Before you reach for your, pen think about what you're going to say. How would you explain the discrepancy to someone — what's the problem; why is it a problem; how can it be corrected? If you have more points to make than you can keep in your head, make a list of random ideas and then arrange them in the best order. Design each of your discrepancies to allow the reader to gain an overall picture of what the problem is.

Open with your main point. Look at your report. What's the one sentence you'd keep if you could only keep one? That's the main point. Don't force your reader to search for it; state the main point first — what the problem is.

By stating what the problem is — up front — you not only refresh the reader's memory but you also get the person thinking about the problem. Readers, like listeners, are put off by people who take forever to get to the point. They need to know the main point at the start so they can appreciate the importance of whatever else you say.

Stick to what your reader needs. Analyze your readers in light of your subject. How are they involved? What do they know already? What do they need to know? Though you can't anticipate all the concerns your readers may have, you should anticipate the main ones. Address the problem areas — be specific about what the problem actually is — and explain the reason(s) why the problem identified affects the public health. For clarification, use paragraphs from AFR 163-8 that also address the problem. Remember also that facts and figures don't speak for themselves; you must say what your details mean. Write to help your readers.

Imagine you're talking to your reader. To get away from the outdated formal style of writing you need to write as though you were speaking to the reader. Now we know that some people speak no better than they write — we're not asking you to jot down every grunt and grumble that you might normally use in speaking to someone. People "hear" writing, however, and the most readable writing sounds like a person talking to a person. In most cases, your listener is going to be sitting in front of you. If you're writing to many different readers and no one in particular, picture a typical reader. Then apply the following tips — the best of speaking.

a. Use personal pronouns. Avoiding natural references to people is false modesty. For example, if you're in charge, use pronouns like I, me, and my. Balance these pronouns with even more of you and your, so your reader gets the most attention.

b. Use contractions, such as "can't"; "won't"; "you'll", freely. Contractions link pronouns with verbs and make verbs negative. Only a few subjects, like reprimands and funeral notices, are too solemn for the informality of contractions.

c. Ask more questions. Use questions now and then to call attention to what you want. You reach out to your reader when you end a sentence with a question mark. An example of this would be asking the supervisor, through the report, how often Civil Engineering should evaluate the facility's insect and rodent control program for adequate coverage.

d. Use small words. Want to get a laugh from readers who are sensitive to words? Substitute majestic words for small ones. Don't start things; initiate them. Don't end things; terminate them. Think of the dude in those old Westerns who overdressed to impress the people on the ranch. Overdressed writing fails just as foolishly. Readers may know that utilize means use and optimum means best, but why force your reader to translate?

e. Keep sentences short. Though short sentences won't guarantee clarity, they're usually less confusing than long ones. Mix short and long sentences for variety. Describing a potentially hazardous action in a food service facility may take a sentence or two; telling the reader that the mops aren't stored correctly doesn't require a paragraph either.

f. Doublings. Avoid writing about a project's importance *and* significance when importance will do. Avoid writing about a facility's dirt *and* filth when dirt will do. Pairs of words with similar meaning add needless bulk to writing.

g. Wordy expressions. Wordy expressions are needless phrases introduced by prepositions, like "at," "on," "for," "in," "to," and "by." They don't give sentences impressive bulk; they weaken them by cluttering the words that actually carry the meaning. Prune such deadwood from your sentence; the longer you take to say something, the weaker you come across.

Instructions. Instructions should not be written using passive verbs. When you describe how to do something, talk directly to your audience. Lead with verbs. "The dishwasher must be cleaned", becomes, "Clean your dishwasher." If your instructions sound like the work of a very important person, they're probably poorly written. Let the signature to the report carry the authority, not the language used in the letter or report. Write actively, as if someone just walked up to you and asked you what to do. To improve instructions further, apply these techniques:

a. State rules before exceptions.
b. State important points.
c. Choose exact words.
d. Say who does what.
e. Give examples for difficult ideas.
f. Divide processes into small steps.
g. Use parallel lists, subparagraphs, and headings.
h. Average only 15 words a sentence.

Keep Lists Parallel. In lists, stick to one pattern. By avoiding interruptions, you set up expectations that make reading easy.

Why write well? In the Air Force and in the Environmental Medicine Career Field, we rarely write to just one person. Even our most routine work is likely to receive many readings. The quality of writing in a single food facility sanitation evaluation report can help the productivity of several dozen workers or slow it down. Give the readers a break! They can throw away a poorly written personal letter, but they have to read your official one.

Write well because poor writing affects more than readers. A confusing instruction can wreck a plane. A clumsy report can ruin the reputation of a fine facility manager.

Write well to help yourself. By turning the impressions in your head into clear writing, you improve your thinking. In the process, your career is likely to improve. Most experts rank communicating among the top requirements for success.

Exercise (408):

1. In this exercise, you're asked to match the principle of effective writing listed in column B with the statement which best describes it in column A. Make your selection by placing the letter of the principle in column B in the empty space provided in front of your selection from column A. Items in column B may be used once, more than once, or not all all.

Column A

___ (1) Your writing will be clear only if your thinking is clear.
___ (2) Don't force your reader to search for it; reveal it by the end of the first paragraph.
___ (3) Analyze your reader in light of your subject.
___ (4) Begin writing by imagining the person is in front of you.

Column B

a. Open with your main point.
b. Stick to what your reader needs.
c. Plan what to say.
d. Always speak in the first person.
e. Imagine you're talking to your reader.
f. Writing instructions.
g. Always keep your sentences short.

___ (5) Ask more questions and use small words.

___ (6) These should never be written using passive verbs.

___ (7) You should anticipate the main needs of your reader.

___ (8) You can often place this in the first sentence.

___ (9) Use of personal pronouns aids you in writing this way.

___ (10) Write actively, as if someone just came up and asked you what to do.

409. Identify specific guidelines and directives used in directing food service operations in the Air Force.

Appropriated Funds Food Service Operations. AFR 146-7, *Food Service Management*, explains how food must be requisitioned, prepared, and accounted for by Air Force food service personnel. It sets procedures for commanders, food service officers and workers, and their designated representatives. Specifically, it states that the Base Commander is responsible for managing the base food service operation, whether it is operated by military or contract food service workers.

Chapter 8 of AFR 146-7 outlines the sanitation standards set for Air Force food service operations. Of primary importance in this section is the statement that the "... food service officer and staff are directly responsible for sanitation in facilities ..." that they control.

Chapter 8 also covers these specific topics:

a. Food-Handler Training — this paragraph makes the food service officer responsible for establishing a training course for food handlers assigned to appropriated fund food service facilities. The course must be given at least twice a year and be of 4 hours duration, at a minimum.

b. Medical Examination of Food Handlers — this paragraph restates that the DBMS sets frequencies for medical examinations.

c. Sanitation Concepts — this paragraph stresses the importance of sanitation and states that the three basic elements for preventing foodborne illness are (1) personal hygiene, (2) time and temperature control, and (3) cleanliness.

AFCOMSR (Air Force Commissary Service) Regulation 145-2, *Store Operations*, discusses sanitation in several departments of the commissary, also an appropriated funds activity.

Chapter 1, Section B, paragraph 1-15 discusses sanitation of the store area. Significantly, this paragraph gives the routing of satisfactory and unsatisfactory sanitary evaluations and states that the Commissary Complex Officer or Region Commanders will insure that corrective action is taken based on our sanitation evaluation reports.

Chapter 5, Section G is entitled "Sanitation" and deals with warehousing of commissary subsistence. This section covers product inspection to ensure edible condition; protection of subsistence from dirt and vermin; the prohibition of smoking in warehouses; and maintaining DD Form 2013 and AF Form 1216 in a location where medical personnel can evaluate them.

Chapter 7, paragraph 7-7, discusses sanitation in the meat department and in delicatessens operated in the store. This paragraph states temperature requirements; cleaning and sanitizing procedures; personal hygiene requirements for department employees, including filing a current DD Form 2013 and AF Form 1216 where medical evaluators may see them; the prohibition of tobacco use, and the requirement for a self-inspection program.

Nonappropriated Funds Food Service Operations. Exchange Service Manual (AAFES) 1-2, *Veterinary and Preventive Medicine Services*, outlines the responsibilities of the Environmental Health Office in providing medical evaluation services to the AAFES. It also outlines reporting procedures for sanitation reports.

Exchange Service Manual (AAFES) 25-4, *Food Operations*, outlines specific responsibilities for store management and sanitation. It places the responsibility for training food handlers in the medical aspects of food handling and performing sanitation evaluations of AAFES facilities on the Environmental Health Office.

AFR 34-3, *Morale, Welfare, and Recreation Basic Responsibilities, Policies and Practices*, outlines the responsibilities of both the Officer and NCO Open Mess Stewards in regard to sanitation in their facilities. No specific responsibilities are defined; however, the requirement for MWR employees to meet the medical and training requirements of AFR 163-8 is stated.

Commercial and State-Operated Food Service Operations. At present, the Air Force allows commercial and state-operated food service operations to function on USAF installations. Such establishments must adhere to the sanitation requirements outlined in the contract signed by the Air Force and the operation's representative. No specific regulation provides guidance in this area — AFR 163-8 should be listed as a portion of any contract signed for providing food services to military personnel. You aren't authorized to evaluate any food service facility under this type of agreement unless you have the prior approval of the operating agency and the base commander.

Exercises (409):

Identify each true (T) statement and explain why the others are false (F).

___ 1. Chapter 8 of AFR 145-2 outlines the specific standards of sanitation prescribed by Air Force Food Service.

___ 2. According to AFR 146-7, base commanders are responsible for managing the base food service operation.

___ 3. In Air Force Food Service operations, the Food Service Officer is responsible for establishing training for food handlers.

___ 4. In AAFES food service facilities, the manager is responsible for providing the medical training to food handlers.

___ 5. The directives that cover Morale, Welfare, and Recreation food service operations are very specific and detailed about who has responsibility for training and sanitation.

410. Cite sanitation evaluation techniques.

In the course of our daily routine we are tasked with medical evaluation of food service facilities on base. This evaluation, according to regulation, calls for a semitrained, military person to assess the bacteriological hazards existent in a facility; the potentials and variables of foodborne illness as related to that facility; techniques of food preparation, storage, and serving; the principles of mass feeding as related to observations of these previously mentioned subject areas; food technology; and interpretation of numerous regulations, manuals and pamphlets that impact on each area. The member also must practice good written and spoken communications skills; counseling skills; proper military bearing, behavior, and appearance; instruction and instructional materials development; and relations with senior military managers.

This person must assume these duties and perform at a qualified level after minimum training at technical school level and moderate training under a base-level OJT program. Naturally the trainer's experiences, prejudices, and values flavor the training; thus the trainee learns not so much about what must be done in an evaluation, but what is to be avoided.

Though the written report of each evaluation is the most valuable product of the evaluation, little or no training may be scheduled to address the "art" of effective writing until the member attends the mandatory Air Force Effective Writing Course, which is usually scheduled long after that member has learned all the "bad" habits of military writing. The evaluator receives just enough coaching from a trainer to perform well enough to qualify for a mark on the "Inspection Board."

Does that sound a bit too pessimistic? In some places, we've seen this occur. You must know from the very outset of our discussion about sanitary evaluation reports that you are in control of the end product. What do we mean? You decide, through your own efforts, how well your reports are written. You decide, through your own efforts, how well the reports initiate corrective action. You decide, because you care about the work you produce, that you're doing your best — which is all we can ask from you.

The sanitation evaluation is one of the most important aspects of the USAF Environmental Health Program. It allows for contact with base food service personnel; health professionals; clerical and service-related jobs; military dormitory residents, and many more. It introduces safe and sanitary work habits into the base working community. It provides education and training in the medical aspects of food handling, foodborne illness prevention, and investigation techniques in the event of an outbreak for food service personnel. It is a people-centered, consumer protection and education agency.

The program reflects the efforts and concern of its staff. If it is staffed with a dedicated, motivated, mature group of military evaluators, a professional relationship is reflected at all levels of contact with base personnel. The program deserves more emphasis as regards the quality of our final product.

When an evaluator becomes qualified to tour facilities without supervision, it is recommended that the first step taken by this new member of the team be a survey of evaluation areas. The new evaluator should survey all the facilities for which he, or she, will be responsible.

A survey usually involves a complete tour of the building, or buildings, inside and outside. This is the evaluator's first chance to become acquainted with the geographics of the area.

When the evaluator satisfactorily completes the surveys, a complete set of working notes from the survey are available. The source of these notes? The inspection files from your office and the regulations pertaining to your job.

The next step in the evaluator's procedures is the time taken to learn the names and positions of the personnel assigned to the facilities to be evaluated. A list for each facility is best and assists in case you forget a name here and there. Know who the manager is, who the receiving officer is, and so forth. It is time consuming, but well worth the effort.

Now that you have your groundwork done, take the time to refresh your memory about the regulations governing your job. You will find that it is extremely difficult to teach others effective methods of sanitation when you don't know any. The more you learn, the more confident you will become. The more confidence you have in your judgement, the more professional your efforts will be.

In preparing for an evaluation, make sure a few things are in place. First, who has authority in the place you are going to evaluate? It is important to know who can take action on your recommendations and who you can go to if you aren't getting full cooperation in the facility. Secondly, always review the regulations prior to performing an evaluation. It refreshes your memory, and it gets you thinking about the areas you need to observe. It also helps you to center your concentration on the job at hand. Finally, coordinate with any other agencies that may be involved with the evaluation (other than the facility itself, of course). Examples are the hospital lab, the physical examination section, bioenvironmental engineer, and perhaps even the base civil engineers office.

These are your preliminary steps to be completed at this point. All your foundations are intact, and you are ready to build your evaluation, not to mention your credibility. Now you need to establish your objectives. How thorough is this particular evaluation? Is there a special area you'd like to concentrate on? Write down the specific data you'd like to obtain.

When you are familiar with your evaluation objectives, take a few minutes to review the previous evaluation reports on the facility. Get an idea, a mental picture as it were, of the place to which you're going. Add that to the notes you took during your initial surveys and you're just about ready to go. You should insure that you have all the equipment necessary to do an adequate inspection; i.e., to meet the objectives you have concerning that facility. When you have the equipment, it's time to go.

The Evaluation. When you enter a food service facility, the first thing you do is introduce yourself to the supervisor. Explain to that person who you are, why you are in the facility, and what your evaluation is basically about. (With time, the latter part of this introduction should be replaced with an explanation of your evaluation objectives for that particular evaluation). You should never forget to explain that you are from the base Environmental Health Office and what your authority is for doing the evaluation.

There are four components to any evaluation. These are (1) physical testing; (2) questioning; (3) observation; and (4) review of previous evaluations and self-inspection reports. Let's discuss these for just a moment.

Physical testing includes your laboratory analysis, any food samples you wish to collect, analyzing the dishwasher equipment, evaluating insect and rodent control measures (fly curtains, etc.), and any drainage testing you need to do. Physical testing is an integral part of any thorough evaluation. Don't forget it!

Questioning involves talking to the people you meet in the facility. Talk about how they do their jobs, how they feel about their jobs, see if the supervisor keeps up the in-house training needed so badly if the sanitation program is going to succeed, and talk to the management people to see how they are handling the workers and their problems. Does management really believe in your program? Questioning means using the art of spoken communication to convey a message of trust, sincerity,and integrity to each person with whom you come in contact.

Observation involves the things you see as you progress through your evaluation. How does each action fit into the total sanitation picture of the facility? How do they reflect against management? Against the work force? Against you as the evaluator and educator? Training your eyes to observe the hidden message behind the surface action is a constant exercise of any evaluator who is determined to be a source of improvement in any sanitation program.

Reviewing past evaluation and self-inspection reports can give you a clear picture of just how seriously the management is treating your assessment of their facility and just how well they're using your recommendations for any corrective action. Remember, just because you wrote down a discrepancy on a previous report does not mean that it cannot be written down again! State what you see!

The Written Report. The first step in preparing your report is to discuss all your findings with the facility supervisor. It is a sign of respect and a good tool for apprising the manager of the facility's status. After you've discussed your written reports with the supervisor, you should begin your formal written report.

The format of the written report is not stressed at present because there is no standard on how to complete an AF Form 977. The method used at your installation is acceptable.

You should, however, include some specific information in your written reports. Several items are covered in the routine filling out of the form itself; others require your memory! You should always record the time of your evaluation. You should always date and sign your evaluation report. You must always explain your discrepancies in your written report. Explain them so that the least educated person can understand what you're trying to imply. You need to tell the reader what the discrepancy is, why the discrepancy is important (from a public health standpoint), and what your recommended corrective actions are.

Each base food service facility is supposed to have a copy of AFR 163-8. How many actually read it? How many use it? If you take the time to explain it to them in your written reports, they'll probably start reading AFR 163-8 and using it to evaluate their programs.

When you recommend corrective action on a problem, you need to construct a solution that can actually be done by the people working in the food service facility. A standard recommendation for each type of sanitary problem that might exist in a facility usually amounts to nothing when evaluated for usability. Each observed problem requires a new solution. The problem is usually just different enough from the last one like it that a standard solution won't change the problem at all. The real question to ask yourself when observing a problem is whether you know how to solve it — do you? There are several agencies on base that can solve your recommendation problems if you'll only give them the opportunity. If you have a problem with the actual building — ventilation, lighting, or drainage — call the base civil engineers. An insect and rodent problem can be solved quite handily by Civil Engineering Entomology. How about the USAF Ground Safety people? Or the Fire Department? Each of these agencies can address specific problems — problems you may not know how to correct. Remember, your job is to provide the food service manager with ways to solve problems you've observed and reported in the facility.

Areas of Concern. The following areas should be considered when you're producing your list of evaluation objectives and when you're in the facility actually doing the evaluation. These areas are:

a. Temperature and humidity.
b. Lighting.
c. Control of disease transmission.
d. Chemical handling and storage.
e. Food-handling techniques.
f. Solid waste (garbage and refuse) disposal.
g. Plumbing.
h. Housekeeping.
i. Pest control.
j. Cleaning and sanitizing.
k. Personal hygiene.
l. Record keeping.

Each of these areas is critical to the safety of the consumer. Where one is allowed to falter, an avenue for the outbreak of a foodborne illness is created. Refer to our earlier discussions about the medical aspects of these areas — see the ways in which the transmission of a foodborne disease can occur? You're never too strict, too curious, or too persistent when it comes to the prevention and control of foodborne illnesses. Remember that.

Followup Evaluations. From time to time, facilities will be awarded unsatisfactory sanitary ratings.

It is a requirement of AFR 163-8 that the OIC, or NCOIC, of the Environmental Health Office conduct the followup sanitary evaluation. Facility supervisors are given set periods of time to correct reported sanitary discrepancies. The AF Form 977, Food Facility Sanitation Checklist, provides space for the supervisor to annotate the dates on which the corrections are made. The followup evaluator must insure that this area of the form is completed. The followup evaluation should be as thorough as the evaluation that brought the initial unsatisfactory sanitary evaluation. The followup inspection is performed to insure that critical abuses are corrected before consumers are endangered, not in order to perform another complete sanitary evaluation. If the facility has corrected the sanitary abuses, then a satisfactory rating can be awarded. If the opposite is true, then a second unsatisfactory rating is given. The Medical and Base Commanders should be brought into the picture at this point. They will take the necessary action to insure that sanitation in the facility is improved. Remember, your duties as an evaluator are to observe, record, and recommend solutions. You are not tasked with the responsibility (or authority) of closing facilities, or recommending the hiring/firing of employees, etc. Stay out of the areas in which you have no responsibility.

Debriefing. You ought to provide the facility supervisor with some form of debriefing before you leave the facility. Show the final report to the manager and supervisor and take the time to listen to their comments. Part of your effort is directed towards establishing rapport with these people — so make the effort!

Make sure you return all of your reference materials and evaluation equipment to their proper storage areas when you return to the office. Insure that the NCOIC reviews your report. Make sure that the report is properly filed and recorded so that you are credited with having done the report.

The final step in this evaluation is to prepare yourself for the next evaluation. Good luck!

Exercises (410):

1. Why is the sanitation evaluation so important to the Environmental Health program?

2. Make a list of the preliminary steps you should perform before doing a sanitation evaluation.

3. List the four components of any sanitation evaluation.

4. Describe physical testing.

5. As far as sanitation evaluations are concerned, what is questioning?

6. What is the first step in preparing a written sanitation evaluation report?

7. What information should always be recorded on your report?

8. What is the key to writing effective recommendations for corrective action?

9. List the areas of concern you should normally evaluate in any food service facility.

10. Followup sanitary evaluations are limited to what areas of the food service facility?

1-5. Recommendations for Improvements

As an observer, your primary purpose is to record what you observe. As that relates to your efforts in doing your reports, it becomes necessary to expand your purpose to include the ability to record observed behavior and make meaningful recommendations for the improvement of that behavior, when necessary. You should understand the mechanics of constructing useful suggestions. Illogical or unreasonable demands in the form of suggested improvement areas can destroy all your efforts at doing useful surveys.

411. Identify and correct ineffective recommendations given a hypothetical report.

Short- and Long-Term Recommendations. Discrepancies you observe in any base facility are usually of a nature that require you to provide both a short- and a long-term solution for each observed problem.

A short-term recommendation is one that solves the immediate difficulty, the behavior or procedure you've observed that doesn't meet outlined requirements. If, for example, a barber shop employee is not cleaning and sanitizing barber tools according to AFR 161-34, *Barber and Beauty Shops*, your short-term recommendation would probably be to describe the cleaning and sanitizing procedure outlined in 161-34, list the paragraphs from the regulation that outline the procedure, and recommend strongly that these procedure be followed. That takes care of the immediate problem. What about the unseen factors that are involved in this problem that you haven't yet addresed.?

What about the attitude of the employees, the level of training they receive, or do not receive, and the quality of supervision offered? These aspects of your problem need to be identified and a long-term recommendation for their improvement made a part of your report. Now you've made an attempt to solve those critical, but unseen, factors of every problem that allow discrepancies to continue for months, and perhaps even years, with no correction made. Remember that short-term solutions are, well, just that — short in duration. If you're making plenty of short-term recommendations on your reports, with no followup of long-term recommendations to help adjust behavior and attitude, then you're going through an exercise in futility. You'll be continually reporting the same, or similar, problems in the same facilities. You'll also be writing the same short-term recommendations. The over-kill those problems will apparently receive (through the eyes of the person reading your reports) will eventually create the illusion that you just don't know what you're talking about, that you're harassing those poor facility employees, and that it's time to get a new body in that job area.

Reasonable Recommendations. At the same time we're discussing the need to look at a problem from the immediate, and long-term, potentials it creates, we need to address the concept of providing recommendations that can actually be understood and accomplished. Let's look at the example we used in the last section — the one about the barber shop employee who wasn't cleaning and sanitizing the barber tools. It is an unfortunate fact of life but some people find it easier to avoid the required cleaning and sanitizing procedures by simply ignoring them. Though it appears that the job is easier because some steps have been cut out, it's actually going to be more difficult, because now our friend is going to have to take twice as much of the work day to repair the reported discrepancy. You, as the observer in this case, have decided to make a recommendation for improving this existing condition in the barber shop. What is a reasonable way to recommend improvement in this instance? (See fig. 1-7 for an illustration of an environmental survey report).

Some of our peers tend to take a great deal of their duty day at a very personal level. Discrepancies they observe become personal insults — easily recognizable when reading their reports. Suggestions ranging from firing the employee to firing the supervisor flood each page of the report. This type of vindictive writing serves only to worsen the situation. At the same time, recommending that the Air Force take a hand in solving the problem may be equally absurd.

A reasonable recommendation actually follows the guidelines listed below:

a. Can the person/supervisor/facility actually perform the recommended solution?

b. Is the recommendation based upon fact, or opinion? Is the opinion based upon known fact, or is it merely an exercise in twisting logic to meet your own needs?

c. Does the recommendation involve expending large amounts of Air Force money, or time? Why? Is there a better way to solve the problem that involves less time, or less capital expenditure?

You cannot ask for something to occur when there

DEPARTMENT OF DEFENSE UNITED STATES OF AMERICA

DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFSC)
BROOKS AIR FORCE BASE TEXAS 78235

REPLY TO ATTN OF (Your Office Symbol)

SUBJECT Environmental Survey of (Facility Name - Be Specific)

TO Responsible Agency's Office Symbol (e.g. Barber Shop - SSE)

1. On (DATE) at (TIME) an Environmental Survey of (FACILITY) was conducted. This survey was conducted in accordance with AFR 161-33, using AFR ________ for guidance and survey criteria.

2. Discrepancies noted, standard(s) not met:

a. Discrepancy, recommendation and standard for compliance.

e.g., a. Barbers were not washing their hands with hot water and soap before attending to patrons. RECOMMENDATION: Training of employees by the supervisor is imperative - training should include information on basic personal hygiene requirements for Barber Shop employment, as well as the importance of preventing disease transmission through good sanitation. In accordance with AFR 161-34. para. 5c.

3. Items observed not affecting public health but requiring attention:

a. List any problem observed and make a recommendation for improvement - your recommendation may be no more than referral of the problem to another agency.

4. The overall condition of this facility (met) or (did not meet) standards prescribed by AFR __________. For further assistance please contact ______ ____________ of the Environmental Health Branch, extension XXXX.

NAME
TITLE (If applicable)

Figure 1-7. Sample outline for environmental survey reports.

is no reasonable expectation that it is possible for it to occur. You aren't going to ask the Air Force to build a new facility just because the one you've surveyed has a problem in design. Once a place is operating it's too late to have it rebuilt. Look at what can be done with what's at hand. Again, looking at our problem in the barber shop, wouldn't it be simpler, and just as effective, for you to suggest that the employee follow the required cleaning and sanitizing procedure? Give the person the necessary information to meet your suggestion; allow time for the information or procedure to be put to use, and followup to make sure that the information was understood and is being used.

Exercise (411):

1. Using the example of an Environmental Survey Report (fig. 1-8), correct the ineffective recommendations listed by writing recommendations that would be more effective given the problems addressed in paragraph 2.

412. Identify proper routing procedures for environmental health survey and sanitation evaluation reports.

Effective Routing. You've constructed a clear, concise, informative report, using the principles of effective writing. Now you need to consider who ought to see the report; who will produce the best results with the information, and who must read it. Is there a required distribution that you must follow?

The report (usually only if it records unsatisfactory conditions, or has been rated unsatisfactory) ought to have the same quality of distribution that it will receive during construction.

Initially you, your NCOIC and OIC should review your report. They may want to discuss possible changes. They may just want to better understand your report. If you wrote it, they ought to discuss it with you. If your report dealt with the base child care center, who ought to be a part of the routing of that report?

The report must go through the Flight Surgeon, as well as your Director of Base Medical Services (DBMS). Either may also wish to make changes to the report, or gain a better understanding of it. Either may want to add additional comments to the report. The DBMS provides technical assistance to the base commander and wing commander concerning the medical aspects of base operations.

After the DBMS completes the reading of your report, it should be routed directly to the base or wing commander. The base commander is responsible for enforcing all the Air Force regulations at the base level. Your report allows the base commander the opportunity to be informed of problems before they impact on the mission of the base. The base commander can adequately manage these problems as long as your report provides logical, timely recommendations.

When the base commander has made appropriate comments on the report, it should be forwarded to the staff officer of the agency concerned with the facility. This provides the staff officer with a copy of your findings, as well as the additional comments of the DBMS and the base commander. You should always route the report so that the final agency responsible for reading it must return it to your office. This provides you with a copy of all comments made on the report, as well as the promised actions that are to be taken concerning your findings. This will become your final file copy; the control copy you've kept in your office files can be disposed of when this report returns to your office.

Courtesy copies of reports are discouraged by the Air Force. Only agencies and individuals who need to know or take action about information in the report should receive a copy of it.

Exercises (412):

Identify each of the true (T) statements and state why the others are false (F).

____ 1. Environmental survey reports should be sent directly to the base commander.

____ 2. A copy of the environmental survey report should be kept in the Environmental Health Office file until the original is returned by the last addressee.

____ 3. Courtesy copies of the environmental survey report should be sent to agencies that formally request them.

____ 4. The DBMS is responsible for providing technical assistance to the base commander, and should receive the environmental survey report.

DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFSC)
BROOKS AIR FORCE BASE, TEXAS 78235

REPLY TO ATTN OF: SGPM

SUBJECT: Environmental Survey of the Walt Disney AFB Child Care Center

TO: SSRN

1. On 19 Feburary 1984, at 0900, an Environmental Survey of the Child Care Center was conducted. This survey was conducted in accordance with AFR 161-33 using AFR 161-37 for guidance and survey criteria.

2. Discrepancies noted, standards not met:

a. The people weren't using the proper technique for the adequate cleaning and sanitizing of their work tools and untensils. The tools were not being cleaned properly and the sanitizing solution was not of any good affect because the cleaning was not properly done. RECOMMENDATION: The supervisor of this facility needs to be terminated immediately. Its the supervisors job to make sure employees are doing what is right, and this one isn't. In accordance with AFR 161-37, para. 9-3.a.

b. The facility is hot and stuffy and the kids are all sick. The air smells terrible and so do the kids. RECOMMENDATION: The Air Force must replace the ventilation system in this facility as soon as possible. In accordance with AFR 161-37, para. 1-1.

3. Items noted not affecting health but requiring attention:

a. The fire extinguishers are all empty. RECOMMENDATION: Get them all filled as soon as possible.

b. The kids are being allowed to stay in the Child Care Center far too late in the evening. RECOMMENDATION: Close the place by 1700 everyday.

4. The overall condition of this facility met the standards. For any further assistance please contact SSgt Dumwaiter of the Environmental Health Branch, extension XXXX.

DONDIE D. DUMWAITER, SSgt, USAF
NCOIC, Preventive Medicine Section

Figure 1-6. An example of an environmental survey report (objective [illegible], exercise [illegible])

Evaluations in Special Environments

THE PERFORMANCE of sanitation evaluations takes place in many environments. As a environmental medicine specialist you'll find yourself evaluating the sanitary status of all food service operations on your base. Though the thought presented here is not surprising to you after your previous readings, there is more to this statement than originally meets the eye.

Certain food service operations deserve special attention. The environment in which they function; the people they feed; and the types of foods they prepare are significantly different from the "normal" food service operation. As a sanitation evaluator, you need to be aware of the special requirements these areas have. In this chapter of Volume 3, we're going to discuss these "special environments" and give you some ideas about why they are so special. In addition, we're going to discuss ways in which you can identify problems inherent in these types of operations and how to suggest correction and improvement when such problems are identified.

2-1. Evaluating Hospital In-flight Kitchens

Medical facilities are designed to identify, and care for, persons who suffer from disease or injury. Additionally, a medical facility has as its major population, people who are debilitated — for one reason or another — and cannot be treated as "normal" consumers when we consider the medical facility's feeding operation.

413. Identify the medical aspects of sanitation evaluations as they relate to the operation of hospital kitchen.

Hospital Kitchen Environment. Medical facilities usually prepare their own meals for patients. These meals are specifically designed by Air Force dietitians to provide nutritional assistance to patients, to prohibit undesirable food substances from affecting medical treatment or patient recovery, and to assist recovery of patients. The specific meals are prepared under guidance of the medical facility's dietitian and handled in a manner similar to a normal food operation. The medical facility operates a dining area for hospital personnel and for those patients who can travel to a dining area, but the significant difference here is that, in many cases, the meals are delivered to the consumer. The utensils and dinnerware used by this patient must be treated as a highly contaminated food contact surface. The organisms that may be transmitted by a hospital patient are, for the most part, unknown to the food handler working in the medical dining facility. It is sufficient for the food handler to understand that the potential for disease transmission in this environment is almost assured unless strict sanitary practices are observed.

Hospital Kitchen Sanitation. In food service operations there are no absolutes. There is never a "pat" answer to any problem observed. Yet, in a medical facility food operation we must constantly strive to insure that the sanitation requirements outlined by AFR 163-8 are enforced by supervisory personnel and adhered to by food handling personnel.

When hot meals are prepared for patients who cannot use the dining facility, the meals are transported to each floor of the medical facility. It is imperative that these meals be transported in clean, sanitary vehicles. The meals must be served on clean, sanitary dinnerware. The meals should remain at 140 °F, or above, throughout transportation. Exceptions will breed inconsistency, and inconsistency will provide the vehicle for an outbreak of foodborne illness. In the dining area of the medical facility, this same rule holds true. Personnel who eat in this area must be served in clean, sanitary surroundings. The meals served must be maintained within the guidelines established by AFR 163-8.

When cleaning and sanitizing the food-contact surfaces in a medical dining facility, take extreme care in following the established procedures. If heat is being used to sanitize, then the temperatures set by AFR 163-8 must be produced. If chemical sanitization is used, then the strengths of each specific chemical solution must be met, monitored, and renewed when necessary. Again, there can be no exceptions to these rules.

Frequent, and adequate, personal hygiene in a medical dining facility is mandatory. The patients who must eat foods prepared in the dining facility are sufficiently susceptible to disease because of their condition. The food handler who transmits a pathogenic organism to a food through careless personal hygiene practices is virtually assuring an outbreak of foodborne illness. In the environment, death can be the final outcome.

Protecting food from contamination involves the complete cooperation of the dining facility employees, the hospital staff, and the medical evaluators. The dining hall employees must adhere to the sanitary practices established by AFR 163-8. It isn't sufficient for any of us involved in the evaluation of these areas to assume cooperation. Coercion won't get the needed results. Education and followup are the only methods that can assure that safe, wholesome foods are being prepared and served to hospital personnel and their patients. The hospital staff, including the dining hall supervisors, dietitian, hospital administrators, and even the DBMS, must understand the importance of sanitation in this area and insure that food handlers are complying with the sanitation standards and procedures of AFR 163-8. Insuring compliance requires active participation by the hospital staff. These people must know their dining facility and the problems inherent in it, the personalities and performance of its employees, and the best means for handling these characteristics without allowing a deterioration in sanitation.

The medical evaluator must strive to educate. At the same time, the evaluator should keep an eye open to ways in which additional assistance can be provided to this facility. Inspect the stock. Is it arriving in poor condition? Is it too old to be stored for any length of time? Is there any problem with the facility providing foods to the medical dining hall? Are there problems with support from other base agencies? Is Base Civil Engineering slow in responding to requests from the medical dining hall? The evaluator must become a partner in the sanitation program in this facility. The assistance that you can provide, if you're willing and able, can far outweigh even the most serious of facility deficiencies. Why? Because the technical knowledge you possess can provide the means for solving those problems. All you need to do is apply yourself.

Exercises (413):

Identify those statements that are true (T) and explain why the others are false (F).

___ 1. The environment in a medical dining facility is no different from that found in any other dining facility.

___ 2. The procedures outlined in AFR 163-8 for handling foods must be strictly adhered to in a medical dining facility.

___ 3. In a medical dining facility, the danger in careless personal hygiene is that foods may lose their nutritional benefits to the patient.

___ 4. It is the medical evaluator who must insure that the medical dining facility employees adhere to sanitary procedures.

414. Associate the medical aspects of sanitation evaluations with the operation of an in-flight kitchen.

The primary purpose of the in-flight kitchen is to provide meals for aircrew members, flight-line personnel, and aircraft passengers. The meals are intended to be wholesome, nutritious, and aesthetically appealing. The in-flight kitchen is an extension of the food service operation and is normally staffed by personnel from the base enlisted dining halls. The critical need for sanitation and careful food preparation is paramount here. The loss of aircraft and personnel through foodborne illness would severely damage the mission of the base and the Air Force.

In-flight Kitchen Environment. In-flight kitchens prepare chilled and hot foods in the form of boxed or frozen meals. The kitchens are usually smaller than other dining or food preparation facilities on base. The lack of space limits their meal selections to sandwiches, certain foods (such as fried chicken) that can be packed in a box format, frozen dinners, suplementary food items (apples, oranges, small cakes, etc.), and beverages (milk, juice, coffee, etc.) that do not require extensive preparation prior to serving. The need for safeguarding the wholesomeness of these foods precludes the use of potentially hazardous foods. The space limitations and the danger of foodborne illness when it occurs in a flying scenario constitute the main reasoning behind this limited meal selection.

The in-flight kitchens are located close to the flight-line.

Meals are stored in components (prepared meal portions — sandwiches, or fried chicken, for example) in reach-in refrigerators for later meal construction. This is necessary because, in most cases, the kitchen personnel don't know how many prepared meals to have on hand until an aircraft arrives and an order for meals is received. The order may range from 4 to 40 meals. Consider also that the meals must be prepared at any time, day or night.

Frozen, in-flight meals are stored in in-flight kitchens. These are foil-packed dinners, very much like a commercial frozen dinner (the Air Force does allow the use of commercially prepared frozen dinners for in-flight feeding). These meals are maintained in a frozen state until they are heated and served aboard the aircraft.

So, the in-flight kitchen must store frozen meals in a quantity to meet the needs of normal flight-line operations. In addition, they must store the components for boxed meals. They must be able to prepare and supply these meals on short notice. During all of these functions, they must adhere to the sanitary standards of AFR 163-8.

In-flight Kitchen Sanitation. Protecting food from contamination, storing foods at safe temperatures, cleaning and sanitizing food-contact surfaces, and maintaining adequate personal hygiene — these are the basics of sanitation in an in-flight kitchen. Surely, it is obvious to you why the outbreak of a foodborne illness in this area would be so severe in its impact. The loss of an aircraft and its crew — besides the financial loss attributed to the incident — would be a tragedy of terrible significance to the families of the aircrew and to the overall mission of the Air Force. The lack of training in proper food handling and sanitation for most personnel in jobs other than food service makes it imperasible to rely on anyone but food service personnel to prevent the outbreak of foodborne disease in this area.

Personnel must practice sound personal hygiene. Illness or infection on the part of a food handler must be reported and treated immediately. Personal cleanliness at all times is mandatory. The supervisor of the facility, as well as the supervisor's supervisor, must insure compliance with the personal hygiene standards outlined by AFR 163-8.

Foods must be stored chilled, or frozen. Foods that are prepared for later meal construction must be labeled with the time and date of preparation. Boxed meals must be labeled with the same information. Frozen meals must be checked for signs of previous thawing, and disposed of when signs of previous thawing are observed. Meals are not to be heated before they are sent to aircraft. At no time should flight-line personnel be served meals that are no longer fit for use in serving aircrews.

The equipment and utensils used in the in-flight kitchen must be cleaned and sanitized in accordance with AFR 163-8. Where heat can be used to sanitize, the temperatures must meet the minimum standards of AFR 163-8. When chemicals are used, the solution strengths must also need specified limits.

Finally, the personnel employed at an in-flight kitchen need to understand and apply the principles for protecting foods from contamination. This requires the application of all of the previous concepts we've discussed in this section. It also requires active participation on the part of these people in observing the condition of foods delivered to them, the condition of foods in storage, and their own attitudes about the job they're performing. We medical evaluators need to do more than stress education here. We also need to impart a feeling to the personnel in this area that we understand the critical importance of their work. This requires our taking the time to observe their routine, honestly evaluate their procedure, and provide them with remarks about the jobs they do well, as well as those they might improve on.

Exercises (414):

1. Why are in-flight kitchens considered special environments.

2. What are the basic sanitation requirements for an in-flight kitchen?

2-2. Evaluating Vending Machines and Mobile and Temporary Food Facilities

Why is it necessary to spend time talking about vending machines? They dispense candy and cigarettes, right? Well — right, they do. They also dispense potentially hazardous foods, and they are located in virtually every office building on every military base in the world. They aren't cleaned and sanitized every day and they are often abused by irate consumers. All in all, they're a significant source for the potential foodborne illness outbreak we're trying to prevent.

415. Cite aspects of vending machine operation that are of importance during sanitation evaluations.

Vending Machine Environment. There are many different types of vending machines. Some dispense canned beverages, others dispense hot or cold beverages in cups. Some vending machines dispense foods in cans, others dispense them in plastic wrap — the food may be hot or it may be cold. Some machines dispense candy, others potato chips and gum. Some only dispense ice cream. In addition, the machines may be located in the back of a warehouse; a type of building not known for having adequate climate control. Some may be located in the center of an office complex, complete with a microwave oven for heating foods and an area for eating the foods after purchase. Some are located in dormitories. Some are located outside next to garages, stores, movie theatres, and any other building that will provide them with electrical power. All in all, vending machines can be extremely hazardous because of their location, the number of people they serve, and the many different types of food they dispense.

Vending Machine Sanitation. There are several areas of concern we should discuss concerning sanitation and vending machines. The most important are:

a. Food storage.
b. Food dispensing.
c. Machine locations.
d. Types of machines.

Food storage. Vending machines have the same requirements for food storage as would any other food storage facility. Vending machines must protect foods from insect or rodent damage. The machine must protect the food from contamination by the environment (the rain, the cold, power loss, etc.) and it must keep the foods at temperatures prescribed by AFR 163-8. If the machine is dispensing a hot food, the food must be canned, held at 140 °F or above, and disposed of after 7 days if not sold. This prevents the consumer from buying a product which has the potential of causing an illness.

If the potentially hazardous food is not to be served hot (or, in other words, if the food cannot be stored in a can), then it must be stored and served chilled — at 45 °F, or below — and the consumer will have to heat the food if so desired. All foods must be wrapped, unless the food has a natural protection from bacterial contamination (apples, oranges, and such), and all foods must be labeled with the date of preparation. Frozen foods (usually ice cream) must be stored at 0 °F at all times.

Food dispensing. When consumers put money into a food vending machine, they expect to receive food they can safely eat. They also expect to receive a food that appears clean and appealing. In order to provide consumers with satisfaction for their expectations, the machines are required to dispense foods that are clean and safe. Pretty simple, right? Well, the specific requirements that allow for the construction of that general statement are these.

The machine must have an automatic shut-off device. This stops the machine from dispensing food when the internal temperature of the machine enters an unsafe zone. Example: If a hot food vending machine's internal temperature drops below 140 °F, the machine must be equipped with a device that returns the consumer's coin and doesn't allow the product to be dispensed. This device must be a part of any machine that dispenses potentially hazardous foods.

The machines must be capable of returning to their required storage temperatures within specific periods of time after servicing. Cold machines must return to 45 °F, or below, within 30 minutes of servicing. Hot machines must return to 140 °F, or above, within 120 minutes of servicing. If this doesn't occur, the automatic shut-off device should prevent dispensing of the product.

The machines must be cleaned and sanitized after servicing. Machines that cannot meet these storage and dispensing requirements must be removed from service immediately.

Machine locations. Vending machines can be found just about anywhere. They're found in dormitories, clubs, gyms, outside garages, and stores — everywhere people are, the vending machines are also. The location of these machines is important. Machines located outside must be protected from insect and rodent infestation. The machines must be protected from the environment. They must be provided with enough space to allow for adequate cleaning of the machines and the immediate area surrounding the machines. The vending machine location also must have adequate trash containers for patron use.

Interior locations must have adequate space for the cleaning of machines and the surrounding area, trash containers, adequate lighting to aid in cleaning, and an area to store cleaning materials that won't allow for contamination of the product. In addition, if a microwave oven is provided, it must be cleaned and maintained by the vending representative and replaced immediately when defective. Condiments may be offered, but they must be individually wrapped — no condiments may be placed into foods that will be stored in any machine.

Types of machines. Approved machines are the only type that may be used on an Air Force installation. How do you know if a vending machine is approved for use? There are three ways to know.

First, if the machine has a National Sanitation Foundation (NSF) seal attached to its exterior surface, it is approved for use.

Secondly, if the machine has a National Automatic Merchandising Association (NAMA) seal attached to its exterior, it is also approved for use.

Lastly, if the machine has been tested by an independent laboratory selected by the Air Force Surgeon General to meet the requirements of NSF or NAMA and approved, it is approved for use. A copy of the letter from the approving laboratory must be attached to the machine.

Remember, the machines that dispense foods to military members can produce severe illness when mishandled, as would any other food if so abused. Don't overlook vending machines — they're right in the middle of your base population, and they can do significant damage if you don't treat them with the seriousness they deserve.

Exercises (415):

1. What factors make vending machines so hazardous to the public health?

2. List the basic areas of concern regarding sanitation of vending machines.

3. How are vending machines approved for Air Force use?

416. Cite aspects of mobile food facility operations that are of significance during a sanitation evaluation.

Ever buy a chili dog from a street vendor, maybe a tuna sandwich and some potato chips from a catering truck? Ever get real sick after eating that little jewel you bought? It's extremely difficult for civilian public health authorities to adequately police these types of food operations. There are so many of them in every state, in every city, and there are so few public health inspectors, that it really is impossible to evaluate them all. So you gamble on stomach upset and probable illness just to get a quick bite to eat from your friendly neighborhood hotdog cart.

The military has a better means of evaluating these types of operations. As you're about to see, we don't want "Harry's Hot Dog-O-rama" stopping the Air Force mission with a dose of foodborne illness of the back of the wagon.

Environment. Dispensing foods on a military installation is a carefully controlled, frequently evaluated procedure. In the case of mobile food facilities — anything from a hotdog cart to an eight-wheel mobile kitchen — the Air Force has its share of problems. The AAFES operates the mobile food facilities on Air Force installations. These mobile facilities have little space for food storage, trash disposal, or for cleaning and sanitizing materials. They are, essentially, food serving areas. There are no "frills" like dishwashing machines on a mobile facility. The operators must sell in order to break even — not just a sale here and there — but sell, sell, sell. When supported by AAFES, the pressure isn't as great to produce. When the operator is contracted to AAFES (which means that AAFES gets a percentage of all profits made on the base), then the operator may crowd the vehicle with products, and rush for sales. The operator may get the feeling that there is little time left for considering such matters as sanitation, stock rotation, and personal hygiene. Yet, the population the operator services is the one that must be ready to perform effectively and efficiently — the military population — and pressure to sell cannot be allowed to outweigh concerns for sanitation and safe food service.

Mobile Facility Sanitation. Operators of mobile facilities have to comply with the requirements outlined in AFR 163-8. The DBMS may add requirements if it appears necessary for public health protection or delete requirements when no public health hazard exists.

Mobile facilities must be staffed by personnel who meet the medical and training requirements outlined in AFR 163-8. The foods dispensed from mobile facilities must be wrapped and produced in fixed facilities that can clean and sanitize according to AFR 163-8, and the mobile facility must meet all the construction requirements outlined in that directive. Operators of pushcarts may not sell potentially hazardous foods. They may sell prewrapped foods,or prepare hotdogs and other sausage products, as long as they adhere to temperature requirements in AFR 163-8.

All mobile facilities are required to provide single-service articles for consumer use. If the facility requires water, the water system must dispense hot and cold water in amounts adequate to clean and sanitize utensils, prepare food, and wash hands.

Mobile facilities can become excellent examples of how sanitation techniques properly applied contribute to effective sales and efficient production. In order for this to occur, medical evaluators, AAFES personnel, and facility operators have to understand and learn from one another what is required to protect the military consumer.

Exercises (416):

1. Which agency is responsible for operating mobile food facilities on Air Force installation?

2. Essentially, what are mobile food facilities?

3. List the sanitary requirements for mobile facilities.

417. Cite aspect aspects of temporary food service facilities that are of significance during sanitation evaluations.

What happens when an agency needs funds to continue operating? It looks for ways to generate money — any legal way possible. Do you know what usually winds up being that chosen way? Right! A bake sale, or a carnival, or a fair! Sounds good, and great for the kids! Alas and alack, it is also a great place to group people who haven't the foggiest idea about how to prepare and handle foods for mass feeding. That neat little money-making idea becomes a prime source for a foodborne illness outbreak. On a military installation it becomes a danger to the entire population unless it is well-organized, well-staffed, and watched carefully by the environmental health office.

Temporary Facility Environment. A temporary food service facility is any nonfixed point from which any food is stored, prepared, and served for a specific period of time. Once that period has ended, the facility ceases to exist. Examples would be hotdog tents at a fair; chili booths or sausage booths at a carnival; bake sale tables; even a squadron-operated snack bar. They're all food facilities — they *are* dispensing foods to consumers — and they do need to be regulated. Consider the fact that most of the people who actually contact the foods and the food-contact surfaces have little or no training in mass feeding operations. True, many have cooked at home. Home cooking is great stuff, but the difference between cooking one 15-pound turkey for the folks and 15 to 25, 30-pound turkeys for all the people on base is rather significant. Consider the time it takes to prepare that large quantity of food. How about the environmental conditions surrounding the area where the food is prepared and served? Airborne contaminants; little or no refrigeration; hundreds and hundreds of people with who knows what kinds of sneezes, wheezes, and drips; and a couple of fine friends standing behind a smoky barbeque grill while their chili sits at 99 °F collecting all the organisms available in the crowd and in the breeze. Net result: an outbreak of foodborne illness; mission deterioration; loss of work hours; and embarrassment for the Base Commander and the DBMS.

Temporary Facility Sanitation. AFR 163-8 sets sanitary standards for these types of food facilities. As with mobile facilities, the DBMS may add sanitary requirements not listed in AFR 163-8 if a significant public health problem exists. The DBMS also may delete certain sanitary requirements when public health is not endangered.

Potentially hazardous foods may be used in temporary facilities if (1) they're prepared and packaged under sanitary conditions (as outlined by AFR 163-8); (2) they are offered in individual servings (not placed in bowls with a "Serve Yourself" scoop stuck in the middle); (3) they are stored at 45 °F. or below, or 140 °F. or above, and protected from contamination; and (4) they are served directly to the patron in an individual unopened container.

If these criteria cannot be met, the only potentially hazardous foods allowed in temporary food facilities are hamburgers and hotdogs – foods that require seasoning and cooking only.

Again, like mobile food facilities, only single-service articles may be used, unless the temporary facility has a means of adequately cleaning and sanitizing all utensils as prescribed by AFR 163-8.

Construction guidance is also offered in AFR 163-8. The main concern when constructing a temporary food facility is that the foods that are to be stored, prepared, and served from that facility are protected from contamination. The facility itself must provide that protection, it must provide facilities for storing foods under safe conditions, and it must be possible to serve foods safely from this facility.

When you are tasked with the responsibility of evaluating a temporary food service facility at your base you ought to take the time to think through the actual sanitary problems that might occur. Can the people working that booth adequately protect the foods during storage? Can they safely prepare and serve the foods they've chosen? Is the area around the booth clean and clear of possible sources of contamination? Is the booth designed so that the consumers can't contaminate foods? Are the people who are preparing and serving food healthy? If you find NO is the answer to any of these questions, then you ought to do some serious talking with the base commander, the DBMS, and the people who're organizing the fair, carnival, bake sale, or whatever. Show them all how they can resolve the problem while stressing the medical importance of really solving the problem. Point of order — if the problem you've observed will probably aid in a foodborne illness outbreak, don't compromise. Make your recommendations, document them, and inform your superiors about why they are significant.

Exercises (417):

1. What is a temporary food facility?

2. Why are temporary food facilities public health problems?

3. When may potentially hazardous foods be served in temporary food facilities?

4. List the questions you should ask yourself when doing a sanitary evaluation of a temporary food facility.

2-3. Medical Evaluations of Aircraft

The health and sanitation aspects of flying have been a concern of the Environmental Health SErvice for many years. The transporting of millions of people all over the world is a magnificent feat. It is also of serious consequence to the public health – in the United States and to the military member stationed in a foreign country – and must be controlled and medically evaluated if the spread of disease is to be prevented.

Military aircraft come in all sizes and shapes. They each have distinct missions and capabilities. The one thing that all military aircraft have in common is that they must provide for the survival of their crews and passengers. This is done by providing food and water as a cargo for all aircraft. Food and water may come in the form of survival rations stored in the rear of a fighter plane's cockpit. It may also come as those frozen inflight meals we talked about earlier, cooked and served by loadmasters, medical evacuation technicians, or other aircrewmembers to their passengers. The means of transmitting disease are available any time food is available. Remember? If people prepare the food, then the potential for contamination is always present.

418. Identify general considerations for hygiene and sanitation in military and commercial-contract aircraft.

General Sanitation and Hygiene. The following standards are, at best, minimum requirements when discussing aircraft sanitation and hygiene. AFR 163-8 requires the sanitary evaluation of all locally assigned aircraft upon which food and water is stored or served. The regulation cites the authority for assigning inspection frequencies to the DBMS.

The general areas of concern in aircraft sanitation and hygiene are that:

a. Food and water be as free of pathogenic organisms as possible;

b. Utensils and food-contact surfaces be clean and sanitary;

c. Waste materials, especially human wastes, be stored in such a manner as to prevent contamination of food and water supplies, as well as crew and passengers; and

d. All disease vectors be kept under control.

All of these listed concerns imply a need for through application of the sanitary standards outlined in AFR 163-8. Because of the speed of air travel, most people who fly to foreign countries are not afforded the time to acquire natural immunities to diseases common on other shores. Illness caused by food or water may seriously detract from a military mission. Considering the areas of the world (and the conditions in those areas) our military now operates in, there is a viable potential for disaster.

Food and water. In military aircraft, you are virtually assured that the water and food supplied to the galley are from approved sources. Commonly, they have been stored under sanitary and safe conditions. They are safe for use and should not cause undue concern. The same cannot be said in general of commercial-contract aircraft that may, in fact, transport military personnel to specific locations. You cannot assume that either the food or the water is safe for use until you have evaluated it for microbiological content and handling procedure.

Though it sounds like all commercial aircraft are flying disease vectors, what we're trying to imply here is that you should never assume anything about the sanitary status of an aircraft until it has been evaluated. Mishandled food aboard a military aircraft can cause illness — even if the food is from an approved source. The sanitary standards outlined in AFR 163-8 apply to the sanitation of aircraft.

Foods must be stored at refrigerated temperatures prior to serving. The Air Force does not allow hot foods to be stored aboard aircraft. The foods must be frozen, as in the case of in-flight frozen meals, and held at 0 °F until preparation. Chilled foods must be held at 45 °F, or below, until they are served. If hot meals are prepared for use aboard aircraft, they must be served immediately after preparation (meals prepared in the in-flight kitchen are a good example). All the rules that we've discussed concerning the labeling of foods and serving of foods, the personal hygiene of food handlers, and protecting food from contamination apply to aircraft galleys.

Water used aboard military and commercial-contract aircraft must come from approved sources. The tanks in which this potable water is stored must be located so that contamination from the sewer storage tanks is prevented. The water must be sampled on a periodic basis to insure that chlorination, etc., is effectively controlling the microbiological levels in the storage tanks. The Bioenvironmental Engineering section is responsible for sampling water from military and commercial-contract aircraft.

Cleaning and sanitizing. It is difficult to clean and sanitize food-contact surfaces adequately. The confined spaces of an aircraft galley add to this problem. In most cases, you will be evaluating the aircraft galley after servicing and cleaning by airport services. The level of cleaning and the proper sanitizing procedure must be closely monitored. Once the plane is airborne, it is very hard to break down a galley to provide needed cleaning.

In most cases, chemical sanitizers are used. The area of concern here is that the procedure for precleaning food-contact surfaces removes not only the organic soils produced by food preparation, but the detergents used to preclean the surface. In many cases, inadequate removal of detergent residues will inactivate the chemical sanitizing agent. Cleaning must be thorough; the cleaning compounds must be completely rinsed away prior to sanitization.

Waste storage. Aircraft designs allow for the storage of human wastes in a belly tank near the latrines at the rear of the aircraft. When comfort pallets are used, there is a waste storage tank built into the pallet. In both cases, the waste is treated with a chemical that is placed in the tank prior to flight. Your major area of concern is in the servicing of the craft. Once airborne, error cannot be quickly corrected. Your job is to insure that the sewage tanks are being cleaned. You aren't responsible for visual inspection of the cleaning procedure in every instance. You do need to insure that cleaning, using proper procedures, is occurring and occasional observation is advised.

Disease vector control. The fact that military and commercial-contract aircraft travel around the world makes disease vector control of primary importance. Exotic insects, animals, and micro-organisms are brought into this country almost every day.

The U.S. Customs Service usually finds these illegal travelers and has them impounded. However, insect infestation aboard aircraft may not be so easily detected or controlled. Everything that comes back into this country from an overseas area should be suspect. An evaluation of the cargo, foods, trash, passengers and crew, as well as the aircraft itself should be accomplished whenever an aircraft arrives in the United States from an overseas area.

Aircraft Evaluation. You're required to evaluate aircraft on which food and water is stored or served. Usually, you'll be limited to those aircraft that provide mass passenger transport — not fighter and bomber aircraft.

On bases that service transient Military Airlift Command aircraft (MAC) you're required to evaluate approximately 10 percent of the total for each month. The DBMS will set evaluation frequencies for assigned aircraft.

The original of your evaluation (Original AF Form 977) is sent to the fleet service that services that aircraft. If you give an unsatisfactory rating, you must send a copy of the report to Headquarters MAC/SGPM, Scott AFB, Illinois.

Contract-carriers must be inspected in accordance with the MAC military airlift contract — here you're reporting on whether the contract is complied with by the carrier. Original reports are sent to the local contract coordinator. Unsatisfactory reports are routed in accordance with AFR 163-8, chapter 11.

Exercises (418):

Identify the true (T) statements and explain why the others are false (F).

____ 1. Only aircraft classified as food facilities need to be evaluated and the frequency of evaluation is once a month.

____ 2. Food and water used aboard all aircraft should be assumed to be safe.

____ 3. Hot foods stored aboard aircraft must be held at 145 °F, or above, until served.

____ 4. Bioenvironmental Engineering samples water from aircraft for microbiological content.

2-4. Off-Base Sanitation Evaluations and Approved Source Listings

Completion of an off-base evaluation is the responsibility of the Environmental Health Officer-In-Charge. Often the OIC will need the experience and assistance of Environmental Health personnel to either perform the routine inspection or accompany and assist the officer in an initial, update, or special inspection. Though our discussion during this section deals mainly with the evaluation of establishments that wish to be placed on approved source listings, you should be aware that the Air Force is no longer involved with the inspection of commercial establishments for placement in Armed Forces approved source listings. These evaluations are now performed by the U.S. Army. Environmental Health may be called upon to perform some sanitary approval inspections in local food establishments. You may very well be ordered to assist in that evaluation. The procedures outlined in this section will be used when performing such an evaluation. Preparation is the best means for providing meaningful assistance.

419. Distinguish among the types of off-base sanitary evaluations.

Initial Sanitary Inspections. These inspections are performed on commercial food establishments when these businesses first request to sell to the Government. These inspections approve or disapprove the establishment as a source of food for the base. Initial sanitary inspections are done using one of two formats. In the first, the OIC evaluates the complete facility, as well as the entire production process, for sanitary abuse or compliance. In the second type, the OIC evaluates the sanitary control system of the facility only. The second type of initial sanitary inspection is most often used when performing an initial inspection on a branch plant of a large, national food producer or distributor. These organizations are usually so well organized and self-policed that an in-depth evaluation would be a waste of time and Government expense.

Inspection requests. Food suppliers who want to sell to the base bidding on available food contracts must file a written request for the initial sanitary inspection with the procurement officer of the base. If the supplier wishes to sell to Walt Disney AFB, then the procurement officer at that base gets the written request. If the supplier wishes to bid on Defense Personnel Support Center (DPSC) contracts, then the procurement officer for DPSC receives the written inspection request. The written request must be signed by the plant owner or an authorized representative.

The procurement officer will review the request. If the supplier meets all the other requirements for bidding, and the base wants the supplier's product, then a DD Form 1231, Request for Veterinary Corps Sanitary Inspection of Establishment, will be sent to the Base Commander for assignment of an inspection.

Inspection procedure. Normally, the plant is approved or disapproved based upon its ability to produce sanitary foods. The initial sanitary inspection is done in the presence of management or a plant representative. The facility and equipment used in the production process being evaluated must be complete and operating before the evaluation begins. The use of Military Standard (MIL-STD) Checklists is required. A sanitary compliance rating (SCR) is used to determine if the facility is approved or disapproved.

Computing an SCR. All MIL-STD Checklists are divided into 3 columns. Column 1 contains the specific sanitation defects to be looked for during the evaluation. Column 2 contains defect points that are assigned to each listed sanitary abuse in column 1. Column 3 is used by the evaluator to award points based upon the severity of the sanitary abuse observed. If the sanitation defect in column 1 is rated CRITICAL and is observed during the evaluation, then the establishment fails the initial sanitary inspection and is disapproved for Armed Forces use (see fig. 2-1).

If the sanitation defect in column 1 has a number assigned to it, for example, 5 points, then the evaluator may assign anywhere from 1 to 5 points for the observed sanitary defect — depending upon that evaluator's rating of the observed problem. You cannot award more points than the number assigned to the defect (column 2), but you may assign a CRITICAL to the defect if necessary and end the evaluation.

At the end of the initial sanitary inspection, these points are totaled; and, using an equation (see fig. 2-2), an SCR is computed. A score below 90 is considered unsatisfactory and the facility is disapproved for Armed Forces use.

Reporting initial sanitary inspections. The general report on the initial sanitary inspection will recommend approval or disapproval. A copy of the letterhead of the inspected establishment will be enclosed with the general report. This general report is submitted as an indorsement to the letter received from the DBMS, who requested you to perform the initial sanitary inspection. You must enclose the MIL-STD Checklist with your report. The general report must list the discrepancies brought to management's attention as well as the specific food items that the establishment wished to sell.

Routine Sanitary Inspections. After an establishment gains approval to sell to the base, it must continue to be evaluated from time to time. Routine sanitary inspections determine the current sanitary status of these establishments. They result in the continued approval of the establishment warning of disapproval if observed

MEAT PROCESSING PLANT SANITARY COMPLIANCE CHECKLIST (CONT'D)	Page 4 of 4 Pages	
SANITATION DEFECTS (1)	ASSIGNED DEFECT POINTS (2)	INSPECTOR DEFECT POINTS (3)
18. PERSONNEL CLEANLINESS AND HEALTH (Cont'd)		
E. Employees not wearing garments/hair restraints suitable for work being performed	5	
F. Storage of employees' personal effects in production rooms	3	
G. Employees affected with or a carrier of a communicable or infectious disease not excluded from products areas	Critical	
H. Plant employees having an infectious wound, sore, or lesion on hands, arms, or other exposed parts of the body not excluded from contacting ingredients, products, or product zone	Critical	
I. Prescribed medical examinations of personnel not being made and/or records of such not available	1	
J. Plant personnel not instructed in acceptable hygienic practices and proper sanitary rules of food handling	Critical	
19. TOTALS		
20. SANITARY COMPLIANCE RATING	a. COMPUTATIONS	b. RATING ASSIGNED

Figure 2-1. Extract from MIL-STD checklist.

$$*SCR = \frac{\text{SUM of COLUMN 2 (assigned defect) points} - \text{SUM of COLUMN 3 (inspector's defect) points}}{\text{SUM of COLUMN 2}} \times 100$$

* SANITARY COMPLIANCE RATING

Figure 2-2. Equation for sanitary compliance ratings.

discrepancies aren't corrected in a specific period of time.

A thorough inspection is required. Serious sanitary discrepancies should be brought to the attention of management immediately. The management must be advised that disapproval may result if the discrepancies aren't corrected. The frequencies for performing routine sanitary inspections are listed in AFR 163-2, *Veterinary Food Inspection.* In some cases, these minimum frequencies may be reduced by the base commander and the DBMS when the establishment shows that it is maintaining a highly acceptable sanitary status. If that status shows a downward trend, then the frequencies in AFR 163-2 may be reinstated.

Special Sanitary Inspections. A special sanitary inspection is made at an establishment to determine if the plant will remain on an approved sources listing. Special sanitary inspections are initiated when:

a. The DBMS, or base commander, feels that the establishment poses a threat to the public health. The DBMS, or base commander, initiates the inspection.

b. The plant fails to correct sanitary discrepancies after a reasonable length of time. The Environmental Health Officer initiates the inspection.

The special sanitary inspection must be performed using the exact criteria established for an initial sanitary inspection. Reports for special inspections are also completed and routed in a manner similar to initial sanitary inspections.

Update Sanitary Inspections. Updating sanitary inspections are performed every 4 years from the date of the initial inspection, or the last special inspection. The updating sanitary inspection is performed in the same manner as an initial sanitary inspection. Overseas, the MAJCOM sets frequencies of updating inspections though the minimum of 4 years must be met.

Exercises (419):

1. List the types of off-base establishment inspections.

2. What is an initial sanitary inspection?

3. How are initial sanitary inspections scheduled?

4. What is a routine sanitary inspection?

5. What is a special sanitary inspection?

6. When are update sanitary inspections performed and what standards apply?

420. Describe the use of approved source lists in terms of format, title, and establishments.

Approved Source Lists. In order for military food inspectors, procurement officers, and food service managers to know in advance whether food suppliers can be used for base needs, an approved sources list, or lists, is produced for easy reference. These lists are updated on a regular basis and provide fairly current breakdowns of who may sell to the Armed Forces. You need to be aware of just how important these lists are, as well as how to use them in your work.

The Directory. The Health Services Command (HSC) produces an approved sources list entitled, *A Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement.* We in the food inspection and food sanitation business call it The Directory. This Directory lists all food establishments and distributors that are approved for Armed Forces use. This Directory is published annually and updated quarterly. The initial, routine, special, and updating sanitation inspections your office performs help to establish and update this Directory. The format of the Directory includes:

a. The name of ech establishment. The names are listed alphabetically by state or country. If the establishment has more than one location, a separate listing for each location is required.

b. The address of each establishment. This describes location by city, street, building number, state, and ZIP Code.

c. The code number for the U.S. Army Veterinary activity making the inspections. This list shows who is performing the sanitary inspections and also identifies what the establishment is approved to do — store foods, store and transport, produce and transport, etc.

Each military installation having food procurement or inspection responsibility receives copies of the Directory. Make sure that the copy of the Directory you're using is current.

Other lists. The following types of plants need not be listed in the Directory. These plants are inspected and listed in publications made by Federal or state inspection agencies:

a. Plants listed in the USDA publication, *Directory of Meat and Poultry Inspection Establishments and Officials.* If an establishment is listed in this publication it may sell foods to the Armed Forces. Most foods produced in plants in this guide will bear USDA or state inspection seals. Some foods produced may not be subject to inspection of any kind and won't bear inspection marks or seals. Look at AFR 163–2, Table 2-2, for a summary of foods that need not be on an approved source listing.

b. Plants that are inspected by state inspection agencies that have been certified as having an inspection program equal to, or better than, the USDA's. Check the inspection service of the state to which you are assigned.

c. Plants that are listed in the USDA publication, *List of Plants Operating Under USDA Poultry and Egg Grading and Egg Products Inspection Program.* These plants may serve as sources of shell eggs, frozen eggs, and dried eggs. You should check this publication to know exactly what egg products each listed plant may sell to the Armed Forces.

d. Plants listed in *Sanitation Compliance and Enforcement Rating of Interstate Milk Shippers* (IMSL), produced by the Department of Health and Human Services, Public Health Services. Plants on this list must have a sanitary compliance rating of 90, or better, to sell to the Armed Forces. These establishments serve as sources of dairy products for the Armed Forces. Again, you need to check the IMSL to determine exactly what kinds of dairy products each listed supplier may sell.

e. Establishments listed in *Approved List, Sanitarily Inspected Fish Establishments* published by the Department of Commerce. Most serve as sources of fish for Armed Forces use.

f. Plants listed in *Dairy Plants Surveyed and Approved for USDA Grading Service* published by the USDA. These plants may also serve as sources of dairy products for Armed Forces use.

g. Plants listed on the *Interstate Certified Shellfish Shippers List.* These plants may serve as suppliers of shellfish for Armed Forces use.

h. Warehouses and distributors who store non-government-owned foods. The foods must be packaged so that they are protected from contamination.

i. Plants located in the United States that produce foods with little or no potential health hazard. A listing of these foods can be found in AFR–163–2, Table 2-2.

j. Foreign produced foods that are imported into the United States by a distributor or broker. These foods receive USDA inspection at arrival and need no further approval for Armed Forces use.

k. Foods produced by foreign manufacturers in the United States that are sold for use in commissaries and nonappropriated fund activities in the United States.

Locally Approved Establishment List. The local base commander may authorize the establishment of a locally approved establishment list when the need appears to warrant such an action. The HSC, or MAJCOM overseas, establishes the procedures for requesting inspection, inspection procedures, reporting, and listing establishments. Use the sanitary standards used in compiling the Directory when establishing a local list.

Exercises (420):

1. Describe the format for the Directory.

2. Cite the publications that exempt plants from Directory listing.

3. Who authorizes and who establishes the procedure for obtaining a locally approved establishment list?

Bibliography

Department of Air Force Publications	**Behavioral Objectives**
AFR 34-3, *Morale, Welfare, and Recreation Basic Responsibilities, Policies, and Practices*	404, 409
AFR 146-7, *Food Service Management*	409, 414
AFR 161-34, *Barber and Beauty Shops*	401, 402, 404, 405, 407
AFR 161-37, *Hygiene and Safety in Child Care Centers*	401, 402, 404, 405
AFR 163-2, *Veterinary Food Inspection*	409, 420
AFR 163-8, *Control of Foodborne Disease*	401, 403, 406, 407, 413, 415, 416, 417, 418
AFR 215-27, *Child Development Program*	405
AFM 88-15, *Air Force Design Manual — Criteria and Standards for Air Force Construction*	404, 405
AFCOMSR 145-2, *Store Operations*	401, 409
ESM 1-2, *Veterinary and Preventive Medicine Services*	402, 409

Answers for Exercises

CHAPTER 1

Reference:

400 - 1. A need to control serious and widespread epidemics.
400 - 2. To establish, provide, and maintain conditions necessary for the prevention of disease.
400 - 3. They control and prevent foodborne disease outbreaks.
400 - 4. The science of controlling or modifying those conditions, influences, or forces that relate to promoting, establishing, and maintaining physical and mental well-being.
400 - 5. In order to identify hazards to our physical and/or mental well-being and to control the harmful effects of known and unknown contaminants.
400 - 6. The ways in which military personnel come into contact with foods on a daily basis make these evaluations essential for the protection of the military members health.

401 - 1. The link between safe, effective mission accomplishment and the continued well-being of Air Force personnel.
401 - 2. (1) Protection from contamination, (2) cleaning and sanitizing, (3) pest control, (4) employee health.
401 - 3. Anything that, when introduced into the body, will cause illness, injury, or death.
401 - 4. The method of entry of the contaminant.
401 - 5. Cleaning is the visible removal of soil from a surface or area and sanitizing is reducing the number of pathogenic and other micro-organisms to a safe level.
401 - 6. The use of heat or chemicals.
401 - 7. We protect the health of the public as well as the financial interests of the Government.
401 - 8. Insects transmit disease and spoil foods.
401 - 9. Rodents transmit disease and destroy foods.
401 - 10. Humans are the single most common source of illness and injury in the working and living environment.
401 - 11. Their abuse means mission deterioration, mission failure, and potential disease outbreak.
401 - 12. Education.

402 - 1. When the lack of comfort, privacy, or facilities can cause hardship adequate to deteriorate an individual's physical and mental well-being.
402 - 2. Light is a form of radiation to which the eyes are sensitive.
402 - 3. It may produce eye strain, an increase in accidents, and ineffective and inefficient work.
402 - 4. The process of supplying or removing air by natural or mechanical means to or from a given space.
402 - 5. Ventilation provides what is needed for an occupant of a space and removes from that space what is harmful to the occupant.
402 - 6. People need specific space in order to live, relieve stress, take care of private needs, socialize, produce work, and relax.
402 - 7. (1) Where you live, (2) your rank, (3) your specific duties.
402 - 8. The physical and mental well-being of occupants.

403 - 1. (1) Food-handling techniques, (2) food-preparation techniques, (3) food wholesomeness, and (4) food-storage techniques.
403 - 2. The types of food being prepared and the time-and-temperature relationship.
403 - 3. Cleaning and sanitizing needs, basic personal hygiene needs, and proper storage temperatures and times.
403 - 4. The longer foods are allowed to remain at temperatures that aid in bacterial growth the more likely it is that the abused food will cause a foodborne illness outbreak.
403 - 5. Keeping food safe for consumption and protecting the financial interests of the Government.
403 - 6. Through education provided by the environmental medicine specialist.

404 - 1. Spacing, adequate latrines, washrooms, lighting, heating, ventilation, and insect and rodent control.
404 - 2. Inadequate cleaning, or illegitimate storage of personal food items, and improper disposal of food waste.

405 - 1. To determine the physical acceptability of the facility.
405 - 2. They help the commander to reinforce work order requests for maintenance or repair work on plumbing, screening, or other areas creating a health hazard.
405 - 3. The grounds, utility connections, trash collection areas, insect and rodent controls, and service buildings.
405 - 4. They are important potential sources for the spread of many communicable diseases.
405 - 5. Center manager, environmental health representative, a physician, a dietitian, and civil engineering and safety representatives.

406 - 1. (a) Human factors, (b) time and temperature exposure, (c) sanitary design of equipment and facilities, (d) cleaning and sanitizing.
406 - 2. People prepare food for people and people transmit disease.
406 - 3. Abuse of principles of time and temperature exposure.
406 - 4. The equipment should be functional and long lasting.
406 - 5. The equipment should be safe from public health hazards and easy to clean.
406 - 6. It reduces the chances of food contamination during preparation, processing, storage, and serving.
406 - 7. AFR 161-8, *Control of Foodborne Illnesses*.
406 - 8. (Appropriated Funds) — Base dining halls, in-flight and alert kitchens; (nonappropriated funds) — NAFIS food facilities and the Officers and NCO Open Messes (OMs).
406 - 9. Provide nutritional meals for health and morale while observing safety, medical, and financial guidelines set by the Air Force.
406 - 10. AFR 161-8 and AF Form 977, *Food Facility Sanitation Checklist*.
406 - 11. Any person who works where unsealed food or drink is handled, processed, prepared, or served and who touches food or food-contact surfaces in any way.
406 - 12. Report to the medical facility for treatment.
406 - 13. Food handlers must pass a medical examination and attend training courses.
406 - 14. The National Sanitation Foundation (NSF).
406 - 15. AFR 161-8 and AFM 88-15, *Air Force Design Manual — Criteria and Standards for Air Force Construction*.

407 - 1. Chlorine, iodine, and quaternary ammonium compounds.
407 - 2. Sanitation can be accomplished by heating food-contact surfaces to approximately 170°F or by immersing them in a chemical sanitizing agent.
407 - 3. The type and condition of soil, type and temperature of water, surface being cleaned, type of cleaning agent, pressure to be applied, and duration of treatment.
407 - 4. Immersion of the object in water at 170°F for 30 seconds and the use of live steam to heat large stationary equipment.
407 - 5. A washing area away from the preparation area equipped with a three-compartment sink.
407 - 6. The equipment is disassembled, the smaller parts being washed and sanitized with the portable food-contact equipment. The large stationary parts are cleaned in place and treated with live steam or rinsed with chemical sanitizing solution.

408 - 1. (1) c.
(2) a.
(3) b.
(4) e.
(5) e.
(6) f.
(7) b.
(8) a.
(9) e.
(10) f.

409 - 1. False. Chapter 8 of AFR 146–7, *Food Service Management*, outlines specific sanitation standards for Air Force Food Service.
409 - 2. True.
409 - 3. True.
409 - 4. False. Medical training for AAFES employees is the responsibility of the Environmental Health Office.
409 - 5. True.

410 - 1. It allows for contact with base personnel, it introduces safe and sanitary work practices, and it provides education and training in the medical aspects of food handling and foodborne illness prevention.
410 - 2. (1) Survey the facilities to be evaluated; (2) learn the names of personnel in the facilities; (3) become familiar with regulations that govern the job; (4) coordinate with other agencies that may be involved with the evaluation.
410 - 3. (1) Physical testing; (2) questioning; (3) observation; and (4) review of previous evaluations and reports.
410 - 4. Physical testing includes laboratory sampling, analyzing equipment functions and evaluating control measures.
410 - 5. Questioning involves talking to the people you meet in the facility — about their jobs, how they feel about their jobs, etc.
410 - 6. To discuss all of your inspection findings with the facility supervisor.
410 - 7. The time of the evaluation, explanation of discrepancies, an evaluation rating, and a signature.
410 - 8. Constructing recommendations that can actually be done.
410 - 9. (a) Temperature and humidity; (b) lighting; (c) control of disease transmission; (d) chemical handling and storage; (e) food handling technique; (f) solid waste disposal; (g) plumbing; (h) housekeeping; (i) pest control; (j) cleaning and sanitizing; (k) personal hygiene; and (l) record keeping.
410 - 10. There are no limitations — followup evaluations should be as thorough as the original evaluation.

411 - 1. (Paragraph 2a) Recommend that the facility begin using single-service articles immediately and that the employees and supervisor attend medical training in proper cleaning and sanitizing. After attendance, regular food-contact surfaces can be restored. (NOTE. You must provide a short- and long-term solution to each listed problem.)
(Paragraph 2b) Recommend additional ventilation be provided through the use of fans and opened windows. Civil engineering should repair the ventilation within the next week to prevent further illness. (NOTE. Provide solutions that can be done.)

412 - 1. False. Reports should be seen first by the NCOIC and OIC of the section for review and clarification. Then the DBMS should receive the report; for the same purpose. The Base commander should receive the report after the review process just outlined.
412 - 2. True.
412 - 3. False. Courtesy copies of reports are discouraged by the Air Force. Only those who need to know should receive report copies.
412 - 4. True.

CHAPTER 2

413 - 1. False. The environment is very different in a medical dining facility. Patients, who can be sources of disease transmission or be more severely affected by disease because of their debilitated condition, are fed in this facility.
413 - 2. True.
413 - 3. False. The danger in careless personal hygiene in a medical dining facility is that patients are more easily affected by foodborne illness organisms and may have a more severe reaction to an organism because of their debilitated condition.
413 - 4. False. It is the responsibility of the entire medical staff to insure that there is compliance with sanitary procedure.

414 - 1. In-flight kitchens are required to store foods for flight feeding and to prepare meals on a no-notice basis; they feed people who operate aircraft and maintain aircraft and their service can have significant impact on operations if a foodborne illness occurs due to sanitary abuses.
414 - 2. Protecting food from contamination; storing foods at safe temperatures; cleaning and sanitizing food-contact surfaces; and maintaining adequate personal hygiene.

415 - 1. The location of the machines; the number of people they serve; and the different types of foods they serve.
415 - 2. (1) Food storage; (2) food dispensing; (3) machine locations; and (4) types of machines.
415 - 3. Through certification by the National Sanitation Foundation (NSF), or the National Automatic Merchandising Association (NAMA), and by certification through testing by an independent laboratory selected by the Air Force Surgeon General.

416 - 1. The Army and Air Force Exchange Service (AAFES).
416 - 2. Food serving areas.
416 - 3. They must be staffed with personnel who have passed a medical examination and attended medical training; foods served must be wrapped and produced in a fixed facility capable of proper cleaning and sanitizing; operators may use single service articles only; and facilities must store enough potable water to wash hands, prepare foods, and clean and sanitize food contact surfaces.

417 - 1. Any non-fixed point from which food is stored, prepared, and served for a specific period of time.
417 - 2. They are staffed with inexperienced food handlers and are normally not equipped to safely store foods for long periods of time.
417 - 3. When (a) they are prepared and packaged under sanitary conditions; (b) they are offered in individual servings; (c) they are stored at 45 °F. or below — or 140 °F. or above and protected from contamination; and (d) they are served directly to the patron in an unopened individual container.
417 - 4. (1) Can the staff adequately protect food during storage? (2) Can the staff safely prepare and serve the food they've chosen to sell? (3) Is the area around the booth clean and clear of sources of contamination? (4) Is the booth designed to protect food from contamination by consumers? (5) Is the staff healthy?

418 - 1. False. All aircraft on which food or water is stored or served must be inspected and the DBMS determines the frequency of inspection.
418 - 2. False. You should never assume anything until the evaluation is completed.
418 - 3. False. Hot foods must be served immediately. Hot storage is prohibited aboard aircraft.
418 - 4. True.

419 - 1. (1) Initial sanitary inspection; (2) routine sanitary inspection; (3) special sanitary inspection, and (4) update sanitary inspection.
419 - 2. An evaluation of sanitary conditions in a plant of distribution point that must be done before the plant or distribution point may bid on Armed Forces food contracts.
419 - 3. The plant or distribution point owner must make written request to the procurement officer of the interested agency to have an initial sanitary inspection done. The procurement officer will forward this request to the base commander who will schedule an initial sanitary inspection with the base Environmental Health Office.

419 - 4. A periodic evaluation done to determine the current sanitary status of approved sources.

419 - 5. An evaluation of a plant or distributor to determine whether the plant or distributor will remain on the approved sources list.

419 - 6. Update sanitary inspections are done every four years, based on the date of the initial, or last special, sanitary inspection. The standards for updating sanitary inspections are the same as for the initial sanitary inspection.

420 - 1. The Directory format includes (a) the name of each listed establishment; (b) the address of each listed establishment; and (c) the code number of the US Army Veterinary activity that performs the sanitary evaluations on the listed establishments.

420 - 2. (1) *Directory of Meat and Poultry Inspection Establishments and Officials*; (2) AFR 163-2, Table 2-2; (3) *List of Plants Operating Under USDA Poultry and Egg Grading and Egg Products Inspection Program*; (4) *Sanitation Compliance and Enforcement Rating of Interstate Milk Shippers*; (5) *Approved List, Sanitarily Inspected Fish Establishments*; (6) *Dairy Plants Surveyed and Approved for USDA Grading Service*; (7) *Interstate Certified Shellfish Shippers List.*

420 - 3. The local base commander may authorize the list. HSC, or the MAJCOM overseas, establishes procedures for requesting inspection; doing the inspection; reporting the inspection; and listing the establishment.

STOP- 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

90850 03 25

FACILITY SANITATION AND ENVIRONMENTAL SURVEYS

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (400) The earliest concern for environmental health was motivated by a

   a. need to find controls for serious epidemics.
   b. desire to provide purer foods to consumers.
   c. need to control the unsanitary food industry.
   d. desire to clean the air of disease organisms.

2. (400) What is the *primary* purpose of performing food facility sanitation evaluations?

   a. To gain access into a food facility.
   b. To followup on food inspection activities.
   c. To prevent foodborne illness outbreaks.
   d. To document daily food operations.

3. (401) What is a contaminant?

   a. Contaminants are limited to toxic chemicals and fumes.
   b. Contaminants are anything that is harmful to the body.
   c. Contaminants are limited to man-made substances.
   d. Contaminants are anything that appears normal but is harmful.

4. (401) Sanitation is defined as

   a. the reduction of pathogenic and other micro-organisms to a safe level.
   b. the removal of all visible soil and bacteria from a surface or area.
   c. the reduction of visible soils on a surface to a safe level.
   d. the removal of all life forms from a surface or area.

5. (401) The single *most* common source of injury and illness is

   a. the infestation of pests in a facility.
   b. the ignorance or apathy of human beings.
   c. the unsafe construction of military facilities.
   d. poor lighting and inadequate ventilation.

6. (402) Poor lighting can be a causative factor in

   a. the transmission of disease.
   b. the increase in accidents in the workplace.
   c. poor food storage technique.
   d. improper cooking of foods.

7. (402) When you evaluate ventilation, the factors you need to look at are

   a. movement, humidity, and temperature of the air.
   b. humidity, temperature, and equipment calibration.
   c. space, temperature, and air movement.
   d. contaminants, air movement, and time.

380

8. (402) Space requirements for individuals are based upon what factors?

a. Time in grade and time in service.
b. Grade, age, and duty.
c. Age, time in service, and grade.
d. Rank, duty, and location of living space.

9. (402) Why are space requirements set?

a. To allow for adequate storage of personal belongings.
b. To prevent overcrowding in military facilities.
c. To prevent disease transmission and maintain mental health.
d. To provide for increased productivity.

10. (403) When discussing food handling techniques critical to disease prevention, we need to cover

a. the types of foods prepared and the time/temperature relationship.
b. personal attitudes towards the work environment.
c. where the foods come from and where they are prepared.
d. military and civilian food service relationships.

11. (403) Food handlers who handle raw and cooked foods need to understand the importance of

a. insuring that raw foods are not contaminated before they are cooked.
b. insuring that cooked foods are not recontaminated after they are cooked.
c. insuring that raw foods are not used for cooking.
d. insuring that they do not contaminate raw foods while cooking.

12. (403) Why are storage temperature requirements set?

a. To make food pleasing to the taste.
b. To keep foods from being contaminated.
c. To inhibit the growth of micro-organisms in foods.
d. To stop food from becoming unfit for use.

13. (403) When dealing with food handlers, the *BEST* method of insuring that they comply with sanitary requirements is

a. to educate them in the reasons why things are done.
b. to make them aware of the punishments for noncompliance.
c. to ask the supervisor to keep an eye on them at all times.
d. to make frequent evaluations of each facility.

14. (404) *All* toilet room doors must be equipped with

a. a sign reminding the patron of handwashing requirements.
b. a self-locking latch to prevent accidental opening.
c. easily cleanable, watertight materials at least 6 inches from the floor.
d. a self-closing device and a latch for secure closure.

15. (404) In well constructed buildings, how often should surveys be done on ventilation, lighting, and heating?

a. An initial survey with biannual, or annual, followups.
b. An initial survey and monthly evaluations.
c. Survey biannually.
d. Survey annually.

16. (405) As regards base trailer parks, your jurisdiction for performing Environmental Surveys is limited to what areas?

    a. Evaluating the trailer interior, food storage technique, and pest control measures.
    b. Evaluating the grounds, trash, and pest control measures, and utility connections.
    c. Evaluating the utlity buildings, the trailer interior, and the food storage technique.
    d. Evaluating the entire park, including the exterior and interior of all buildings and trailers.

17. (405) When developing a trailer park site for Air Force use, one of the considerations is

    a. the elimination of disease vector harborages.
    b. the location's access to the surrounding community.
    c. the number of times trash will be removed daily.
    d. the location's impact on base operations.

18. (405) Children in Child Care Centers are usually grouped according to their

    a. sex.
    b. size.
    c. age.
    d. health status.

19. (405) What is the *commonly* accepted space requirement for children in Child Care Centers?

    a. 15 square feet.
    b. 20 square feet.
    c. 30 square feet.
    d. 35 square feet.

20. (405) The required air changes in a laundry operation are

    a. one complete air change an hour.
    b. 15 complete air changes an hour.
    c. one complete change every two minutes.
    d. 15 complete changes every two minutes.

21. (405) When hot water *cannot* be used in the laundering of an article of clothing, what should be done to prevent disease transmission?

    a. The item of clothing should be discarded immediately.
    b. The item of clothing should be returned to the owner for cleaning at home.
    c. The item of clothing should be exposed to air and sunlight to inhibit bacterial growth.
    d. The item of clothing should be treated with a germicidal agent to prevent bacterial growth.

22. (405) What is the frequency of Environmental Surveys for off-base establishments?

    a. The frequency is determined by the DBMS.
    b. Off-base establishments are not normally routinely surveyed.
    c. The surveys must be done twice a month.
    d. Off-base establishments are surveyed biannually.

23. (406) How do people affect foodborne disease outbreaks?

    a. They are the only cause of disease in a food facility.
    b. People don't affect foodborne disease outbreaks.
    c. They are the main cause of disease in a food facility.
    d. People are a minor cause of foodborne disease outbreaks.

24. (406) The key to foodborne disease prevention is an understanding of

a. the principles of effective verbal communication.
b. the basic principles of subsistence rotation.
c. the ways in which water can contaminate foods during storage.
d. the relationship of time and temperature to disease prevention.

25. (406) When evaluating the design of foodservice equipment, or facilities, the Environmental Medicine member *must*

a. stress the sanitation requirements in approving each design.
b. allow for compromise of sanitary needs because the designs may become too expensive.
c. design the features that will be used in constructing the equipment or building.
d. accept the design features that the facility owner needs.

26. (406) Effective sanitation is dependent upon what initial activity?

a. Food procurement.
b. Cleaning.
c. Food preparation technique.
d. Design.

27. (406) What are the basic guides for performing sanitation evaluations in food service operations?

a. AFR 163-8 and AF Form 977.
b. AFR 163-8 and AFR 146-7.
c. AFR 163-8 only.
d. AF Form 977 and AFR 146-7.

28. (406) A food handler is defined as anyone who works around

a. wrapped foods.
b. unsealed foods.
c. stored foods.
d. any foods.

29. (406) Which of the following duties would *not* be classified as a food handler's job?

a. Working on the serving line in a base dining hall.
b. Washing dishes in an AAFES Cafeteria.
c. Servicing a vending machine with wrapped sandwiches.
d. Working in a salad bar in an Officer's Open Mess.

30. (406) Who is responsible for reporting a foodhandler's illness to the medical facility?

a. The base safety officer.
b. The Environmental Medicine Specialist.
c. The facility manager.
d. The foodhandler who is ill.

31. (406) According to AFR 163-8, what *must* food service supervisors examine each day?

a. Their workers, for signs of illness or injury.
b. Their facility, for signs of damage or dirt.
c. Their records, for training and examination dates.
d. Their food storage areas, for signs of pest infestation.

32. (406) After the initial medical examination, how often *must* food handlers receive medical examinations?

a. At least once each year.
b. No more than once every four years.
c. As required by the Director of Base Medical Services.
d. As required by the Environmental Health Officer.

33. (406) The DD Form 2013, Medical Certificate, is used for

a. recording foodhandler training dates.
b. reporting sanitation evaluations.
c. scheduling foodhandler medical examinations.
d. recording foodhandler medical examinations.

34. (406) How long after attending preemployment training must a foodhandler attend annual training?

a. Within 6 months.
b. Within 90 days.
c. Within one year.
d. Within 120 days.

35. (406) Medical training of foodhandlers is recorded on

a. DD Form 2013.
b. DD Form 1232.
c. AF Form 1216.
d. AF Form 977.

36. (406) Which of the following agencies develops design standards for food service equipment?

a. The National Sanitation Foundation (NSF).
b. The USAF Civil Engineers.
c. The US Public Health Service (USPHS).
d. The USAF Medical Services.

37. (406) All customer-contact and food-contact surfaces *must* be cleaned and sanitized

a. daily.
b. at the beginning of each shift.
c. as needed.
d. after every use.

38. (407) When selecting a detergent for cleaning, you should consider which of the following areas?

a. The amount of cleaning to be done and who will do the cleaning.
b. The places where the cleaning will occur and what will be cleaned.
c. The type and temperature of the water and what soils are to be removed.
d. The equipment that will do the cleaning and how often the cleaning must take place.

39. (407) How long *must* an item remain immersed in hot water (170° F) for sanitization to occur?

a. No less than 30 seconds.
b. No more than 30 seconds.
c. No less than two minutes.
d. No more than two minutes.

40. (407) The three *most* common chemicals used in food service sanitation are

a. iodine, ammonia, and alkalines.
b. alkalines, quaternary ammonia, and chlorine.
c. quaternary ammonia, ammonia, and iodine.
d. chlorine, iodine, and quaternary ammonia.

41. (407) What's an easy way to tell the concentration of iodine in a solution?

a. Taste the surface being sanitized.
b. Look at the color of the solution.
c. Read the label on the iodine container.
d. Have the laboratory analyze the solution.

42. (407) High water temperatures (120° F or higher) affect chemicals in what way?

a. Chemicals may explode at higher water temperatures.
b. More chemical is needed to offset the higher water temperature.
c. Foodhandlers may not use chemicals when the water is too hot.
d. Chemicals tend to leave the solution at higher water temperatures.

43. (407) What *must* be done to barber tools if a patron is suspected of harboring a communicable disease or infection?

a. The tools must be disposed of after they are used on that patron.
b. The tools must be cleaned after use on that patron.
c. Barber tools will be disinfected in a 10% lysol solution.
d. Barber tools will be sanitized in a 25% iodine solution.

44. (407) The first step in manually cleaning and sanitizing *most* food contact surfaces is

a. cleaning the work surfaces in a washing area away from the food preparation area.
b. washing the item in water heated to 120° F.
c. presoaking the item to remove gross soils.
d. rinsing the item in water heated to 140°.

45. (407) What is the *final* step in manual cleaning and sanitizing operations?

a. Cleaning the work area.
b. Washing the hands to prevent contamination.
c. Heating the sanitizing water or strengthening the chemical sanitizer.
d. Air drying the sanitized items.

46. (407) What is the time period established for chemical-spray sanitization of stationary equipment?

a. No more than 30 seconds, using normal strength solution.
b. Two to three minutes, using double strength solution.
c. No more than 30 seconds, using double strength solution.
d. Two to three minutes, using normal strength solution.

47. (408) What principle of effective writing requires you to analyze each paragraph for a specific topic?

a. Planning what to say.
b. Sticking to what your reader needs.
c. Imagining that you're talking to the reader.
d. Opening with your main point.

48. (408) When you're writing instructions, you should write with what thought in mind?

a. You are in charge and you're setting the rules.
b. You've just been asked by someone what should be done.
c. You may have to follow the instructions too so make them as easy as possible.
d. You want your boss to like them so make them tough.

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49. (409) According to AFR 146-7, *Food Service Management*, who is responsible for sanitation in food service operations?

a. The Base Food Service Officer.
b. The Base Commander.
c. The Environmental Health Officer.
d. The Director of Base Medical Services.

50. (409) The four-hour training course established by the base Food Services Officer *must* be given

a. at least once each quarter.
b. no more than once each year.
c. every time medical training is presented.
d. at least twice a year.

51. (409) According to AFCOMSR 145-2, *Store Operations*, who *must* ensure that action is taken on unsatisfactory sanitary reports?

a. The Director of Base Medical Services.
b. The Commissary Complex Officer.
c. The Environmental Health Officer.
d. The Base Commander.

52. (409) According to the Army and Air Force Exchange Service, who is responsible for providing medical training to foodhandlers?

a. The Environmental Health Office.
b. The facility manager.
c. The Base Commander.
d. The Base Food Services Officer.

53. (409) What guidance will you always have to follow when evaluating a State, or commercially operated food service facility?

a. AFR 163-8, *Control of Foodborne Illnesses*.
b. The procedures directed by the Base Commander.
c. The contract in force with the facility and the base.
d. AF Form 977, *Food Facility Sanitation Checklist*.

54. (410) The *first* step a new, qualified evaluator should take in performing sanitation evaluations is

a. learning the names of the people who work in food service facilities.
b. refreshing the memory about the directives that govern sanitation evaluations.
c. surveying the establishments that will be inspected.
d. coordinating the inspections with other base agencies.

55. (410) What should the evaluator do after establishing evaluation objectives?

a. Read the old inspection reports to get a picture of the facility condition.
b. Read the directives that govern sanitation evaluations.
c. Contact the facility and record the names of the people who work there.
d. Survey the facilities that will be inspected.

56. (410) When entering a food service facility, the *first* thing an evaluator *must* do is

a. check the evaluation equipment for proper functioning.
b. review the evaluation objectives for adequacy.
c. ask if the supervisor has a copy of AFR 163-8 available.
d. explain to the supervisor why the evaluator is in the facility.

57. (410) Taking samples of foods for laboratory analysis comes under what evaluation component?

a. Questioning.
b. Observation.
c. Review.
d. Physical testing.

58. (410) An evaluator who looks for the hidden message behind an action seen in a food service facility is exercising what component of the evaluation?

a. Questioning.
b. Observation.
c. Review.
d. Physical testing.

59. (410) What is the *first* step in preparing a written evaluation report?

a. Reviewing previous written evaluations to identify repeat discrepancies.
b. Discussing your observations with the facility supervisor.
c. Delivering your laboratory tests to the medical laboratory.
d. Finding a suitable site for writing the report neatly.

60. (410) Information that *must* be part of your written sanitation evaluation report includes

a. what the discrepancy was, why it is a problem, and what recommended corrections should be made.
b. the number of major problems observed, the location from which samples were taken, and the time it took to do the evaluation.
c. who when with you during the evaluation and the names of those foodhandlers who were in violation of health standards.
d. your NCOIC's name, duty phone number, and the date when you accomplished the inspection.

61. (410) A question you should ask yourself when observing a public health problem is

a. "Is it really all that bad?"
b. "Whose fault is it?"
c. "Can I solve this problem?"
d. "Can I safely ignore it this time?"

62. (410) According to AFR 163-8, who is responsible for conducting follow-up evaluations for unsatisfactory food service facilities?

a. The Director of Base Medical Services.
b. The Environmental Health Officer-In-Charge.
c. The Base Food Services Officer.
d. The facility supervisor.

63. (410) A follow-up sanitary evaluation of an unsatisfactory facility should cover

a. those areas specified by the Base Commander.
b. the areas selected by the DBMS only.
c. the areas that are obviously wrong.
d. the entire facility, as is done on a normal evaluation.

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64. (410) Who is responsible for ensuring that follow-up reports are completed?

a. The Environmental Health NCOIC.
b. The secretary of the office.
c. The administrative specialist for the office.
d. The evaluator who wrote the report.

65. (411) A short term recommendation solves the

a. immediate problem observed.
b. attitude problems seen during evaluations.
c. need to give recommendations for correction.
d. need to write long term recommendations.

66. (411) Long term recommendations solve the

a. immediate problem observed.
b. attitude problems seen during evaluations.
c. need to give recommendations for correction.
d. need to write short term recommendations.

67. (411) The *best* recommendation for correction is one that

a. is easily accomplished and understood by the reader.
b. removes any doubt that a problem exists.
c. explains exactly what the problem is.
d. addresses the commander of each facility.

68. (411) Follow-up recommendations lets the evaluator

a. keep an eye on the food handlers.
b. remain a familiar sight in the facility.
c. think up better ideas for the next evaluation.
d. make sure the recommendations were understood and used.

69. (412) What should be done before your written evaluation report is routed from your office?

a. All agencies receiving copies should be notified.
b. The OIC, and NCOIC, should review the report.
c. The DBMS should review the report.
d. The report should be rewritten to meet local needs.

70. (412) Why do we route reports so that our office is the final distribution point?

a. This routing saves on information copies to base agencies.
b. This routing provides our office with a file copy of the report.
c. This routing allows our office to see all the comments made by each reader.
d. This routing lets everyone at base level know what's happening in the facility.

71. (413) Why is the environment in a medical dining facility considered of special concern to the evaluator?

a. It is often poorly operated because the medical staff is not concerned with its operation.
b. The consumers in this environment can transmit diseases to other patients, foodhandlers, and base personnel.
c. Medical dining facilities are very large and hard to operate satisfactorily.
d. The special meals prepared in this facility are better media for potential foodborne illness outbreaks.

72. (414) Why are potentially hazardous foods prohibited from use in in-flight kitchens?

a. They are hard to safeguard within a limited facility like the in-flight kitchen.
b. Personnel are of such a low caliber that only foods difficult to contaminate are used.
c. Aircrew members are prohibited from consuming potentially hazardous foods during aircraft operations.
d. The in-flight kitchen prepares meals on a no-notice basis and it takes too long to prepare these types of food.

73. (414) From the following select the *BEST* statement concerning food storage in in-flight kitchens.

a. Hot foods must be maintain at 140° F or above until they are served.
b. Frozen meals are for aircrew use and should not be used to feed flight-line personnel.
c. All foods will be stored chilled or frozen until heated aboard the aircraft.
d. Prepared meals will be served by qualified food handling personnel.

74. (415) Vending machines can be considered dangerous as regards public health because

a. vending machines are never properly cared for and often dispense spoiled, or contaminated, foods.
b. vending machines dispense many different types of foods to many people in locations that are difficult to keep sanitary.
c. it is easy to hide contaminated foods in a vending machine and this practice is common.
d. people who use vending machines tend to vandalize them to a point where they're no longer able to maintain foods safely.

75. (415) If potentially hazardous foods are *not* to be vended hot from a vending machine then the food must be

a. wrapped in plastic and labeled with proper cooking directions.
b. disposed of by the machine serviceman as soon as possible.
c. chilled to 45° F, or below, and dispensed at that temperature.
d. cooled to 0° F and dispensed at that temperature.

76. (415) Which of the following temperatures would cause the automatic shut-off device in a chilled food vending machine to operate?

a. 35° F.
b. 40° F.
c. 45° F.
d. 50° F.

77. (415) When vending machines are stored in interior locations they must be

a. equipped with exterior thermometers to adequately gauge equipment temperatures.
b. cleaned by personnel who are assigned to that location.
c. situated where there is adequate space for cleaning the machines.
d. stocked by qualified foodhandlers only.

78. (416) Why are mobile food facilities of concern to Environmental health sanitation evaluators?

a. They move around so often that it's hard to know where they'll be next.
b. They are small, limited in what kind of sanitation they can perform, and they're often rushed in their work.
c. These facilities are always changing the people who work in them and it's hard to educate anyone about sanitation.
d. AAFES controls these food facilities and it is difficult to meet AAFES sanitation standards.

79. (417) If potentially hazardous foods cannot be stored, prepared, served in accordance with AFR 163-8, then the only potentially hazardous foods a temporary food facility may serve are

a. those which require handling before serving.
b. those which are commercially produced.
c. items which require seasoning and cooking only.
d. items that are cooked from a frozen state.

80. (418) Hot meals prepared for use aboard aircraft must be served

a. within one hour of preparation.
b. no more than thirty minutes after preparation.
c. immediately after preparation.
d. after they are chilled.

81. (418) Who is responsible for water sampling from military and commercial-contract aircraft?

a. The Base Commander.
b. The Environmental Health Officer.
c. The Bioenvironmental Engineering Section.
d. The Base Fleet Service.

82. (418) On bases that service transient Military Airlift Command (MAC) aircraft, the Environmental Health Service *must* evaluate

a. all MAC aircraft upon which food and water is stored or served.
b. all MAC aircraft that remain on-base for more than one day.
c. at least 50% of all MAC aircraft each month.
d. 10% of the total number of aircraft for each month.

83. (419) Which of the following sanitary inspections of off-base establishments is usually done every four years?

a. Special sanitary inspection.
b. Update sanitary inspection.
c. Routine sanitary inspection.
d. Initial sanitary inspection.

84. (420) The initial guide for determining whether an establishment is allowed to sell foods to the Government is commonly called the

a. Directory.
b. Basic List.
c. Inspection Catalog.
d. Approved Contractors List.

85. (420) Who may authorize the establishment of a locally approved establishment list?

a. The Director of Base Medical Services.
b. The Environmental Health Officer.
c. The Base Commander.
d. The Base Contracting Officer.

END OF EXERCISE

MAIL TO: ECI, GUNTER AFS AL 36118-5643

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012. PRINCIPAL PURPOSE: To provide student assistance as requested by individual students. ROUTINE USES: This form is shipped with ECI course package, and used by the student, as needed, to place an inquiry with ECI. DISCLOSURE: Voluntary. The information requested on this form is needed for expeditious handling of the student's inquiry. Failure to provide all information would result in slower action or inability to provide assistance to the student.

I. **CORRECTED OR LATEST ENROLLMENT DATA**

1. THIS REQUEST CONCERNS COURSE (1-6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER

5. SOCIAL SECURITY NUMBER (7-15)	6. GRADE/RANK	7. NAME (First initial, second initial, last name)
_ _ _ – _ _ – _ _ _ _		(17) – (18) – (19-32)

8. ADDRESS
OJT ENROLLEES–Address of unit training office with zip code.
ALL OTHERS–Current mailing address with zip code.
(33-53)
(54-75)

9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE

10. TEST CONTROL OFFICE ZIP CODE/SHRED (33-38)

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1	Request address change as indicated in Section I, Block 8.
2	Request Test Control Office change as indicated in Section I, Block 10.
3	Request name change/correction. *(Provide Old or Incorrect data here)*
4	Request Grade/Rank change/correction.
5	Correct SSAN. *(List incorrect SSAN here.)* *(Correct SSAN should be shown in Section I.)*
6	Extend course completion date. *(Justify in "Remarks")*
7	Request enrollment cancellation. *(Justify in "Remarks")*
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 10 Originals were: ☐ Not received ☐ Lost ☐ Misused
9	Send course materials. *(Specify in "Remarks")* ☐ Not received ☐ Lost ☐ Damaged
10	Course exam not yet received. Final VRE submitted for grading on __________ (date).
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 10 not yet received. Answer sheet(s) submitted __________ (date).
12	Results for CE not yet received. Answer sheet submitted to ECI on __________ (date).
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14	Give instructional assistance as requested on reverse.
15	Other *(Explain fully in "Remarks")*

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REMARKS *(Continue on reverse)*

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I certify that the information on this form is accurate and that this request cannot be answered at this station.

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SECTION III: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

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Answer You Chose ______ (Letter)

Has VRE Answer Sheet been submitted for grading?

☐ Yes ☐ No

REFERENCE
(Textual reference for the answer I chose can be found as shown below)

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In ☐ left ☐ right column

Lines ____ Through ____

MY QUESTION IS:

REMARKS

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. Course workbooks have a Form 17 printed on the last page.

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CDC 90850

ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

Volume 4

Food Inspection and Technology

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PREFACE

THIS FOURTH volume of the 90850 CDC covers food inspection and the technological advances that have occurred in food production, storage, and preparation in the last few years. Chapter 1 discusses food technology and terminology for animal origin food products; covering anatomy and physiology; food processing techniques; packaging, packing, and storage requirements; dairy product technology; and egg product technology. In Chapter 2 information on non animal origin food products is covered, including fruits and vegetables, grains, spices, and other semiperishable foods. Chapter 3 discusses military procurement of foods. Chapter 4 covers food inspection and deals with the types of inspection programs you will be involved with as a military food inspector.

For easy reference Appendix A provides sample tables for Chapter 4. Use it as the text directs.

A glossary of terms used in Chapter 4 of this volume is included at the end of the volume.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

This volume is valued at 33 hours (11 points).

Material in this volume is technically accurate, adequate, and current as of August 1984.

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Food Technology for Animal Origin Subsistence

IN SEPTEMBER, 1940 the United States Army Quartermaster School at Fort Lee, Virginia, published a school text entitled *Inspection of Subsistence Supplies.* In an introduction to the publication the writers stated that the chief purposes of providing subsistence inspection were to safeguard the health of the Armed Forces and to protect the financial interests of the Government.

In forty years, nothing has changed about the spirit or intent of that statement. The purposes of food inspection have remained constant. Through thorough inspection, for wholesomeness and contract compliance, the military food inspector assures the consumer and the Government that the chief goal of subsistence inspection is met.

This fourth volume of your career development course provides you with the job knowledge to become a part of that ongoing program. You will learn the technical language of the food procurement world, the anatomy and physiology of the food animals associated with military feeding, the military procurement system and how it works, and how all of the federal and civil inspection agencies come together to provide a safe and wholesome food source for the military and you.

You will be addressing consumer level quality audit program (COLEQUAP) and operational ration inspection programs, and the forms and publications you must become familiar with in order to perform as a food inspector. You will also see (after all these months of hard work and constant study) exactly how everything fits together to from the Environmental Health Food Inspection Program.

1-1. Terminology and Anatomical Features

In this section, we will discuss some of the basic anatomical features associated with food inspection work. You will study the bovine anatomy predominantly, with special emphasis on those food animals that have systems different from the bovine. Here you will learn how each system works and why that knowledge is important to your duties as a food inspector.

Foods of animal origin represent a large percentage of the military subsistence procurement budget, both in cost and in food value. As a food class, they are not only the most perishable but also the most difficult to judge for quality and wholesomeness. They are also excellent media for contamination and transmission of foodborne illness bacteria—organisms that are common to the food source animal but pathogenic to man, the consumer.

The inspection of foods of animal origin is, for these reasons, of great importance to the military, and especially to the USAF Medical Service. As environmental health food inspection personnel, you will need a basic understanding of animal anatomy and the terminology that is associated with that anatomy. This knowledge is vital to a comprehensive knowledge of the Air Force food inspection program.

600. Identify basic anatomical structures/units with the terms that specify their location within the animal body and supply examples for selected terms.

Cells. The meat animal is a massive unit made up of numerous cells which combine to form tissues, organs and systems. The cell is considered the smallest unit within the body capable of independent life and function. There are five types of cells: epithelial, connective tissue, blood, muscle, and nerve.

Epithelial cells. Epithelial cells form tissues that cover and protect the body. Examples are skin, hair, hooves, and feathers. These cells also form tissues that line body cavities, such as the serous and mucous membranes.

Connective tissue cells. Connective tissue cells hold other specialized cells together to form tissues and organs. Cells forming the frame work of bone, cartilage, tendons, and ligaments are examples.

Blood cells. Blood cells are unattached, free-floating cells which move through the blood vessels transporting food, oxygen, and water to body cells and carrying wastes away from the cells. Examples of these are red and white blood cells.

Muscle cells. Muscle cells are fiberlike cells that constitute the muscle tissue.

Nerve cells. When nerve cells are banded together, they form nerves. The nerves are of several types: those of the central nervous system (brain and spinal cord); the peripheral nerves, which supply skin and appendages; the motor nerves, which supply muscles of locomotion; and the sympathetic nerves, which provide autonomic reflex action.

Tissues. A combination of two or more of the same type of cells bound by connective tissues form a tissue. Thus, we can assume that tissues are basically composed of cells of a particular kind or type. To further clarify this similarity, let's discuss two types of tissues.

Epithelial tissues. Epithelial tissues may be categorized into internal and external epithelia. External epithelial tissue is the skin (hide) of the animal. Internal epithelial lines the cavities of the body and is divided into mucous membrane and serous membrane. Mucous membrane lines those body cavities that have external openings. These include the digestive and reproductive tracts, the lungs, and the urinary tract. Serous membrane lines the two inclosed cavities of the body. The serous membrane lining the thoracic cavity is called *pleura;* that lining the abnominal cavity is called *peritoneum;* and that lining the heart is the *pericardium.*

Connective tissues. Connective tissues vary in consistency and chemical composition. Some examples are fatty tissue (such as the fat marbling in beef), white fibrous tissue (in ligaments and tendons), yellow elastic tissue (in the ligamentum nucha) or backstrap (in the neck region), cartilage (in the buttons at the end of the dorsal spine of the vertebrae), and bone (the supporting framework of the body).

Organs. We know the cells and tissue are capable of independent function; however, we must realize that body function is improbable without the incorporation of two or more tissues into major body organs. Examples of body organs are the stomach, heart, liver, and spleen—each having numerous and varied combinations of tissues which act together to provide a vital body function.

Anatomical Terms Associated with Direction and/or Position. In the study of anatomy the terms associated with direction and/or position within the meat animal are extremely important in the determination of wholesale/retail meat cut identification. These basic terms are:

Ventral—directed toward the plane of support (the ground), the belly, or bottom line of the standing cow.

Dorsal—directed away from the plane of support (the back or topline of the cow is most dorsal).

Median—a vertical plane, passing through the vertebral column, dividing it into similar halves (sides of beef).

Medial—directed toward the median plane.

Lateral—directed away from the median plane.

Anterior—toward the head or cranial region.

Posterior—toward the tail or caudal region.

Proximal—expresses a distance closest to the long axis of the body. This term is used to describe locations that are at right angles to the long axis of the body; i.e., the limbs.

Distal—expresses a distance away from the long axis of the body.

Exercises (600):

1. Define these anatomical structural terms and give two examples of each:
   a. Cell.

   b. Tissue.

   c. Organ.

2. Match the anatomical terms in column B with their appropriate definitions in column A. Place each letter of column B in the proper space provided in column A. Each column B item may be used once, more than once, or not at all.

Column A

___ (1) Directed toward the head of the standing 4-legged animals.
___ (2) Expresses a distance closest to the long axis of the body.
___ (3) Divides the body into two equal halves.
___ (4) Describes a distance close to or away from the median.
___ (5) Directed away from the median.
___ (6) Close to the median.
___ (7) Directed toward the back or topline of the standing 4-legged animal.
___ (8) Directed toward the plane of support of the standing 4-legged animal.
___ (9) Directed toward the tail of the 4-legged animal.
___ (10) Terms used to describe locations based on distance at right angles from the long axis of the body.

Colum B

a. Ventral.
b. Dorsal.
c. Median.
d. Medial.
e. Lateral.
f. Anterior.
g. Posterior.
h. Proximal.
i. Distal.

601. Associate the eight animal systems with their physiological functions and state the major components in each system.

Animal Systems. The terminology associated with animal system is, for the most part, consistent no matter what food animal is being discussed. Food animals, such as the calf, lamb, and pig, all have this common terminology, both in commercial and anatomical terms. Here we will use the bovine anatomy as our example of animal systems and the associated anatomical terminology. Where a particular animal's system differs from our general discussion, we will pay particular attention to that difference or differences.

The organis a functional unit within the body only when it is supported by other organs of the body. Thus, a combination of two or more organs forms a system. Within the body there are the skeletal, muscular, nervous, digestive, circulatory, lymphatic, respiratory, and urogenital systems.

The Skeletal System. The skeletal system is divided into three components: axial, appendicular, and joints.

The axial skeleton. This includes the skull, vertebral column, ribs, and sternum. The skull of a cow (fig. 1-1) consists of 29 bones, many of them fused. As such, the skull is not especially significant in meat inspection, but you must remember certain landmarks when you are performing such necropsy procedures as removing the brain for the diagnosis of rabies or listeriosis.

The vertebral column consists of irregular bones (vertebrae) extending from the skull to the tail. This acts as a beam in supporting the animal body. The vertebral column surrounds the spinal cord and is divided into five regions.

Cervical vertebrae. Cattle have seven of these vertebrae. These are the first vertebrae in the vertebral column and make up the neck region.

Thoracic vertebrae. Cattle have 13 of these. Each vertebra has a rib attached.

Lumbar vertebrae. Beef cattle have six of these. They are in the region of the loin.

Sacral vertebrae. There are five of these vertebrae, collectively called the *sacrum.* They are located in the region of the pelvis.

Coccygeal vertebrae. The coccygeal vertebrae form the tail. There are from 18 to 21 in cattle; in other species their number varies. Of the animals which we will study, the vertebral formulae show the greatest variation in numbers of vertebrae among the coccygeal vertebrae. Vertebral formulae serve as useful landmarks for learning cuts of edible meat, and inspection points, of food animals. Below are the vertebral formulae for the cow, pig, sheep, and chicken (C = cervical, T = thoracic, L = lumbar, S = sacral, CY = coccygeal):

Cow – $C_7T_{13}L_6S_5CY_{18\text{-}21}$
Pig - $C_7T_{14\text{-}15}L_{6\text{-}7}S_4CY_{20\text{-}23}$
Sheep - $C_7T_{13}L_{6\text{-}7}S_4CY_{16\text{-}18}$
Chicken - $C_{14}T_7L\&S_{14}CY_6$

Ribs are long, curved, somewhat flattened bones which junction (articulate) with thoracic vertebrae. Cattle have eight pairs of sternal ribs and five pairs of asternal ribs. Sternal ribs connect with the sternum, while asternal ribs do not. Asternal ribs are also called *floating ribs.*

The sternum is the breastbone; it consists of seven bones called *sternebrae.* They are separated by cartilage in the young animal but are fused into solid bone in the older animal.

The appendicular skeleton. The appendicular skeleton includes the bones of the pelvic limbs (hindlegs) and the thoracic limbs (forelegs). The thoracic limb of an animal corresponds to the human arm; the pelvic limb, to the human leg.

Beginning with the bones of the foreleg, the *scapula* (bladebone) is a flat bone that lies on the lateral anterior surface of the thorax. The *humerus* is a long bone of the upper arm that articulates proximally with the scapula and distally with the radius. The *radius* and *ulna* are long bones of the forearm that articulate proximally with the humerus and distally with the carpus. The ulna projects dorsally and posteriorly to form a prominence called the *elbow.* The carpus is commonly referred to as the *knee* of animals. It consists of six bones arranged in two layers and is the anatomical division between the foot and the leg. This group of bones is comparable to the bones in the human wrist.

The *metacarpus* is a long bone that articulates with the carpus and phalanges. The *distal epiphyseal* joint is cartilaginous in lambs and ossified in mature sheep, where it is commonly known as the *spool joint.* The *phalanges* (digits) have six phalanx bodies and six sesamoid bones.The third phalanx forms the hoof in the horse. It is comparable to your middle finger. The other phalanges compare to the bones in your hand.

Turning now to the bones of the pelvic limb or hindleg, the pelvis consists of three pairs of flat, fused bones—the *ilium, ischium,* and *pubis.* The pubis is the middle ventral part of the pelvis. The fusion of this middle portion is called the *symphysis pubis.* When a carcass is split in the middle, the symphysis is exposed and this bone is commonly called the *aitchbone.* The

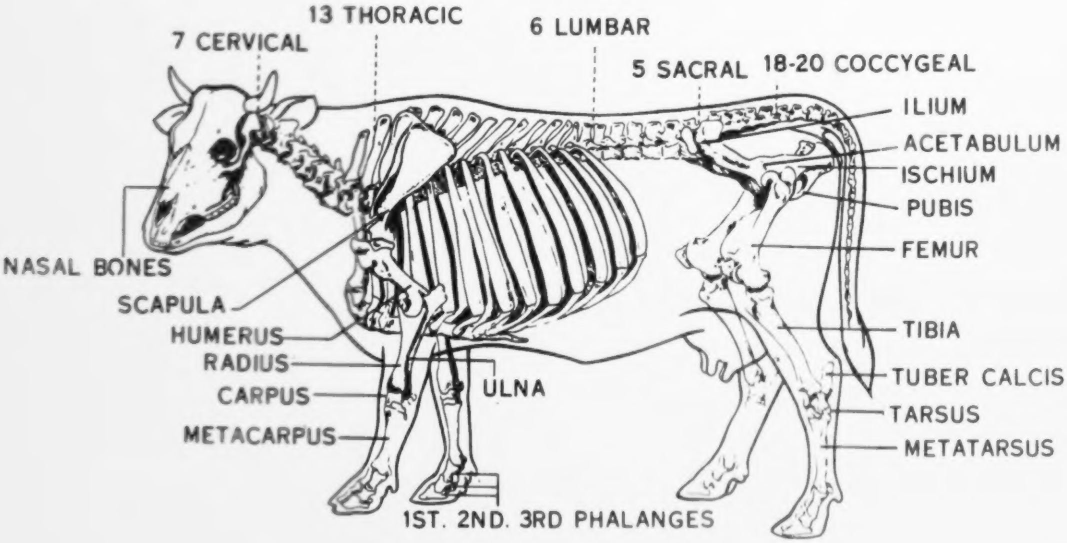


Figure 1-1 Bovine skeleton.

aitchbone is an important landmark in inspection procedures, such as sex determination and proper cutting methods. The *femur* is a long bone that articulates proximally with the *pelvis* (hipjoint) and distally with the *patella* (kneecap) and the tibia. The patella is a short bone that articulates at the distal extremity of the femur. The *tibia* is a long bone with its proximal end articulating with the femur and the patella. The distal end of the tibia articulates with the *tarsus.* The *fibula,* a rather long bone located laterally to the tibia, is not easily identified as a separate bone and is a nonarticulating bone. The tarsus forms the hock joint, consisting of five to seven short bones. It is located directly below the tibia on the pelvic limb. Directly below the tarsus are the *metatarsal* bones. They are comparable to the metacarpus of the front leg.

Joints. All joints can be placed in two broad categories—movable and immovable. *Movable joints* are classified according to type of construction and action of movement and include the ball-and-socket, hinge, pivot, and gliding joints. *Ball-and-socket* joints are those in which the rounded end of one bone fits into a cuplike cavity of another. Such a joint permits a greater degree of motion than do the others. The *hip* joint is a particulary good example of this type of joint, with the femur fitting into a socket in the pelvis. *Hinge* joints, such as the knee, permit movement of one bone about the transverse axis of another. *Pivot* joints allow one bone to rotate around a second stationary bone; e.g., the pivot joint between the first and second bones of the vertebral column. *Gliding* joints permit little motion except that provided by one bone sliding a short distance over the surface of another. The closely packed bones of the carpus furnish an example of a gliding joint. *Immovable joints* are fixed articulations in which there is no movement of one bone upon another, such as the bones of the skull. The line of union between immovable joints is called the *suture.* Study figure 1-2 to compare general skeletal system terminology to carcass beef landmarks.

The Muscular System. Muscles are highly specialized organs which have the property of contracting when they are stimulated. Three types of muscle tissue exist: *striated, smooth,* and *cardiac.* These types are classified as *voluntary* (under conscious control) and *involuntary* (not under conscious control).

Striated muscle. Microscopically, this type of muscle consists of fibers with cross striations and a peripherally located nucleus. The cell membrane is called the *sarcolemma* and is responsible for the texture (tenderness or toughness) of a muscle. Each muscle fiber has its own nerve supply for receiving stimuli in order to contract on a voluntary basis; therefore, tissues composed of these types of fibers are known as *voluntary* muscles. Once stimulated the fibers contract to the maximum of their ability, known as the *all-or-none* principle. Striated muscle tissue and some connective tissue comprise the flesh of meat-producing animals. See figure 1-3 for an artist's concept of a striated muscle.

Smooth muscle. These muscles are located in the walls of the digestive tract and the reproductive, vascular, and urinary systems. Their fibers contract more slowly than striated fibers and respond involuntarily to various stimuli. Microscopically, their shape is spindlelike, and each cell has a centrally located nucleus. This type of muscle is known as an *involuntary* muscle, as shown in figure 1-4.

Cardiac muscle. This type is characterized by striated muscle cells which are very similar to those of the skeletal muscle, except that they appear to branch and have centrally located nuclei. Cardiac muscles are found primarily in the heart, but some are also found in the walls of large blood vessels. The heart muscle functions in a spreading contraction wave on an involuntary basis; therefore, it, too, is an involuntary muscle.

You will use muscle terminology in many aspects of your job. Important terms to know concerning muscled anatomy are: *origin, belly* or *body,* and *insertion.* Origin refers to the point where the muscle is anchored. It consists of a short tendon which is attached to a bone. The midportion and largest part of a muscle is the belly or body. It consists of many individual fibers and bundles of fibers. The other end of a muscle attachment is the insertion. Action is applied at this point to produce motion. Other terms used as we speak of muscles are *extensors* and *flexors* and *tough* and *tender* muscles.

Extensors and flexors. These are responsible for the mobility of joints in the animals. When flexors contract, they cause the angle of a joint to flex or close, resulting in movement. Examples of flexors are those muscles causing the jaw to close or the legs to be bent at the knee. Extensors produce the opposite motion from flexors, causing a joint to be extended or opened. Examples of extensors include muscles to open the jaw or to straighten the leg. Abdominal muscles are important in supporting viscera, in respiration, and in expelling feces, urine, and the fetus at parturition (birth). The structure which separates the abdominal and thoracic cavities is the diaphragm. When the diaphragm contracts, air is inhaled into the lungs; when it relaxes, air is exhaled. Since early deterioration may begin under the diaphragm of a slaughtered animal, this muscle is an important landmark in checking the condition of meat carcasses.

Tough and tender muscles. The more use a muscle receives, the larger, tougher, less palatable, and less valuable it becomes. The number of muscle cells never increases, only the size of these cells. Therefore, as muscles become larger, more connective tissue will be deposited within muscle groups, making that particular muscle more tough. Some examples of tough muscles are outside round, shank meat, and chuck meat, which contain more connective tissue. Loins and inside rounds are more valuable and contain less connective tissue. These are good examples of tender muscles.

The Nervous System. The brain is the only nervous tissue that is used for food; however, a knowledge of the nervous system is important in identifying certain diseases in food animals and working animals. The system is divided into central and peripheral systems.

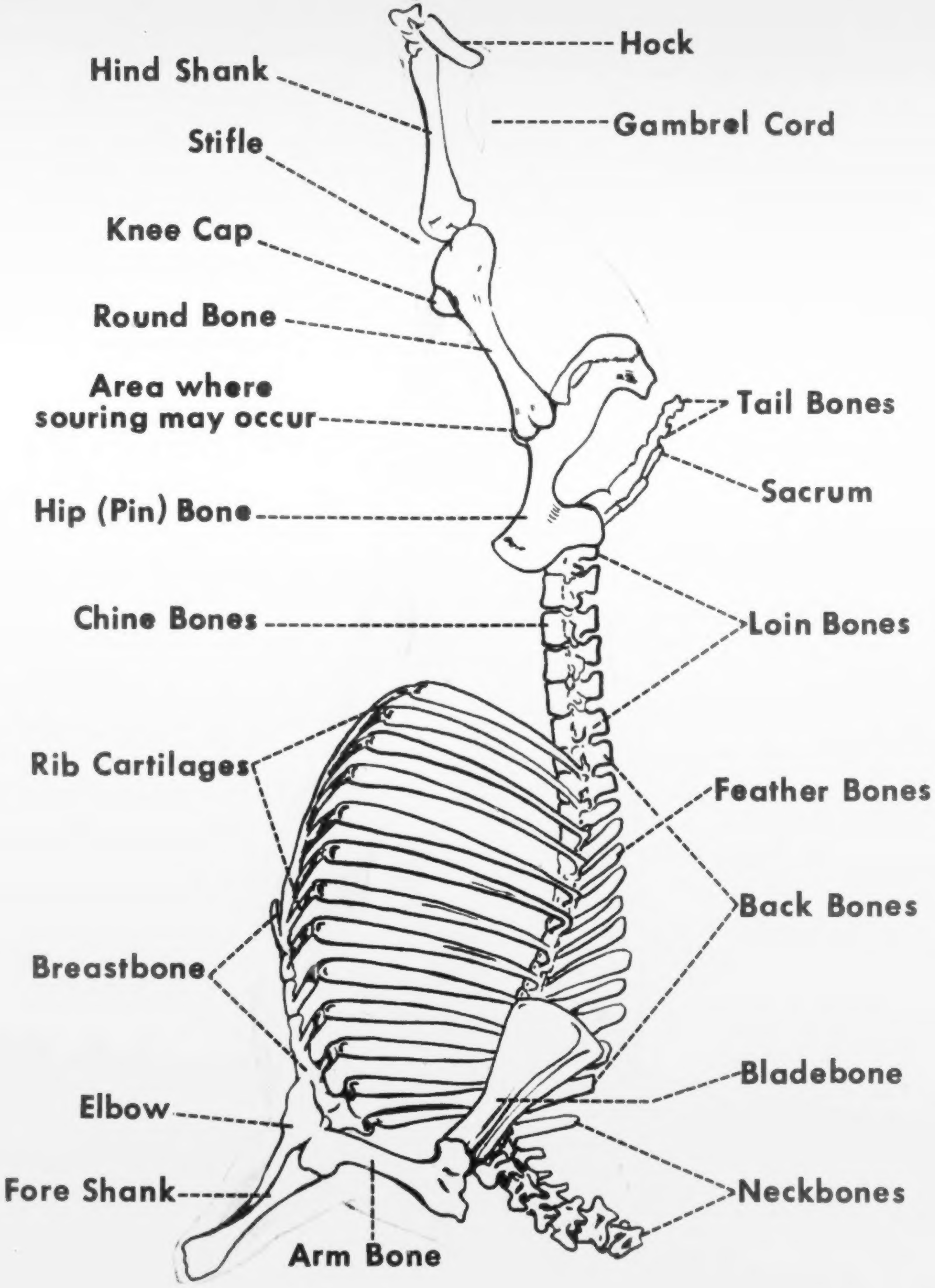


Figure 1-2 Beef skeletal chart.

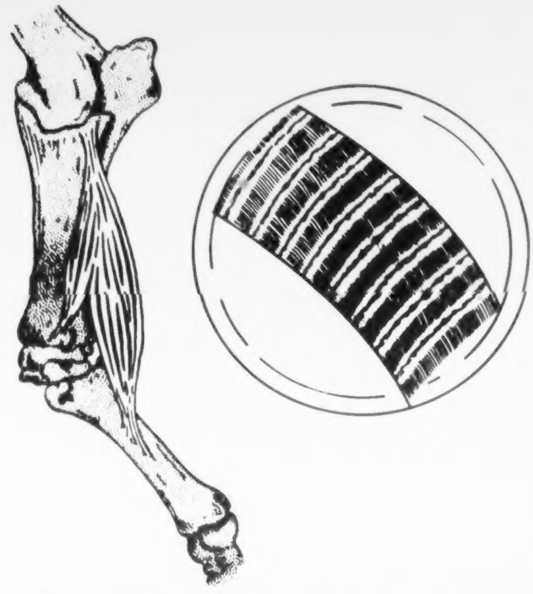


Figure 1-3 Voluntary muscle and skeletal muscle fiber.

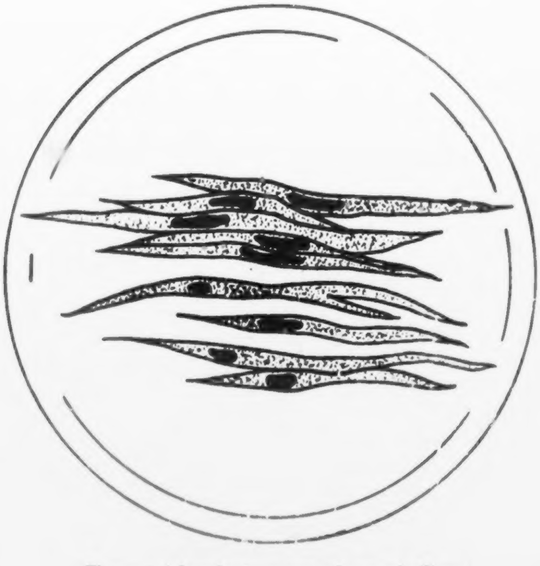


Figure 1-4 Involuntary smooth muscle fiber.

Central nervous system. This consists of the brain and the spinal cord. The brain can store information, generate thoughts, and determine reactions that the body should perform in response to the sensations. Appropriate signals are then transmitted through the spinal cord to the peripheral system.

Perpheral nervous system. The peripheral nervous system consists of the cranial nerves and the spinal nerves. There are 12 pairs of cranial nerves. The spinal nerves are arranged in pairs, and named according to their anatomical relationship to the vertebral column. These are the *cervical, thoracic, lumber, sacral,* and *coccygeal* nerves. The spinal nerves are connected to the spinal cord by a ventral and a dorsal root.

There are two kinds of nerve fibers. Those that pass through the dorsal root of the spinal cord are called the *sensory* nerves; they carry impulses to the central nervous system. The others, called the *motor* nerves; pass through the ventral root and carry motor impulses to all parts of the body.

The Digestive System. The only digestive system we will discuss here is that of the cow (bovine). The bovine system includes the *alimentary canal*, which runs from the mouth to the anus, and the *accessory organs,* consisting of the salivary glands, liver, pancreas, and gallbladder. In this system, both mechanical and chemical processes take place to make food usable by the body. The mechanical actions are chewing, swallowing, regurgitation, peristalsis (alternate contraction and relaxation), and defecation. The chemical reactions are the breakdown of foods by gastric juices and enzymes to make them usable by the cells of the body. As we discuss the following structures of the digestive system, refer to figures 1-5 and 1-6.

Mouth. The main function of the mouth are prehension (grasping) and mastication (chewing) of food. The teeth and tongue help in both functions. The age of the animal can be reasonably determined by certain characteristic changes that occur in the animal's teeth.

Salivary glands. Three major salivary glands—producing a clear, alkaline, somewhat this solution—are located in the region of the mouth.

Parotid salivary gland. This is the largest gland and is located in the upper part of the cheek below the ear.

Mandibular salivary gland. This gland is located just back of the mandible.

Sublingual salivary gland. This one is located medial to the mandible under the tongue.

Pharynx, esophagus, and stomach. The *pharynx* is a canal that leads from the nose and mouth to the esophagus (also spelled *oesophagus).* When food is about to be swallowed, the tongue pushes it back, the larynx is closed by the epiglottis, and the food is passed into the esophagus. The *esophagus* is the structure through which food passes from the mouth to the stomach. Food is moved downward by rhythmic contraction of the muscular wall of the esophagus. The bovine *stomach* consists of four compartments: the rumen, reticulum, omasum, and abomasum.

Intestines. The small intestine in the adult bovine is about 130 feet long. It has three parts—the duodenum, jejunum, and ileum. Digestive juices are secreted into the small intestine from the pancreas and liver.

The ingesta passes from the small intestine to the large intestine. Between these intestines, and projecting from the large one, is the *caecum* (or cecum), where further breakdown of food occurs. The large intestine is about 35 feet long. Liquids that are not absorbed in the small intestine are absorbed here.

Accessory organs. The *liver* and the *pancreas* are the most important accessory organs in the digestive system. The liver secretes bile, which is stored in the gall-

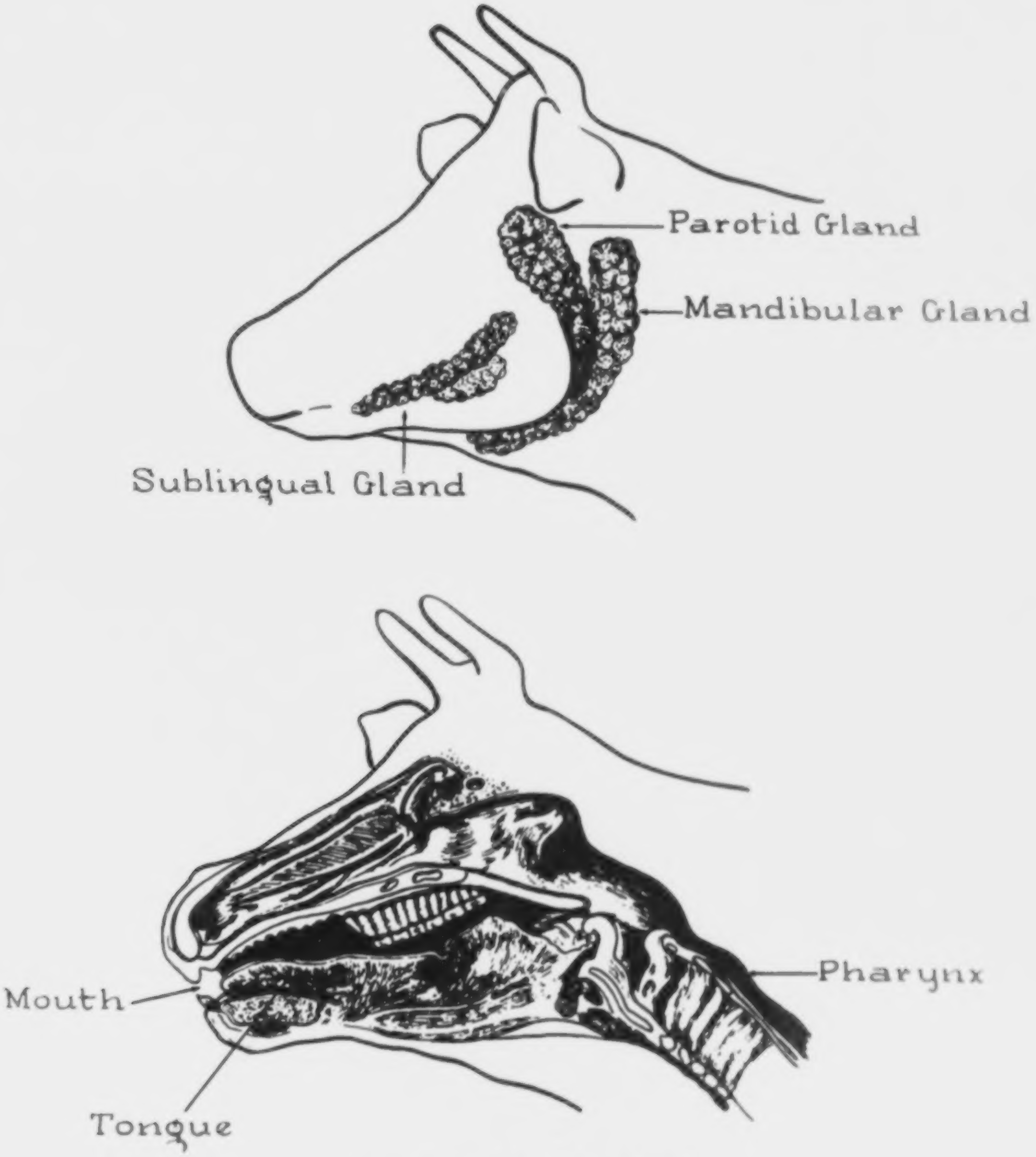


Figure 1-5 Digestive system of the bovine.

bladder. Bile aids the conversion of raw fats to glycerol and fatty acids, and it changes waste products to urea for elimination by the kidneys. The pancreas secrets insulin, which controls sugar in the body. It also secretes pancreatic juice, which digests protein, carbohydrates, and fat.

The Circulatory System. The circulatory system carries oxygen and food to the cells and carbon dioxide and waste from the cells. This system consists of the blood and the heart and its blood vessels (arteries, capillaries, and veins). The heart, shown in figure 1-7, has four chambers. It is divided vertically in the middle by a septum and horizontally into the upper and lower halves. A fibrous tissue called the *pericardium* surrounds the heart. Structures of the heart wall are the outer layer (the epicardium), the middle or muscular layer (the myocardium), and the inner layer (the endocardium). The tissues that make up the valves between the atria and the ventricles are from the endocardium.

The blood vessels consist of three subsystems—the *pulmonary, systemic,* and *portal.* In the pulmonary system, the blood is passed from the right ventricle, through the pulmonary artery, to the lungs for oxygenation. The oxygenated blood is returned through the pulmonary vein to the left atrium. The systemic system

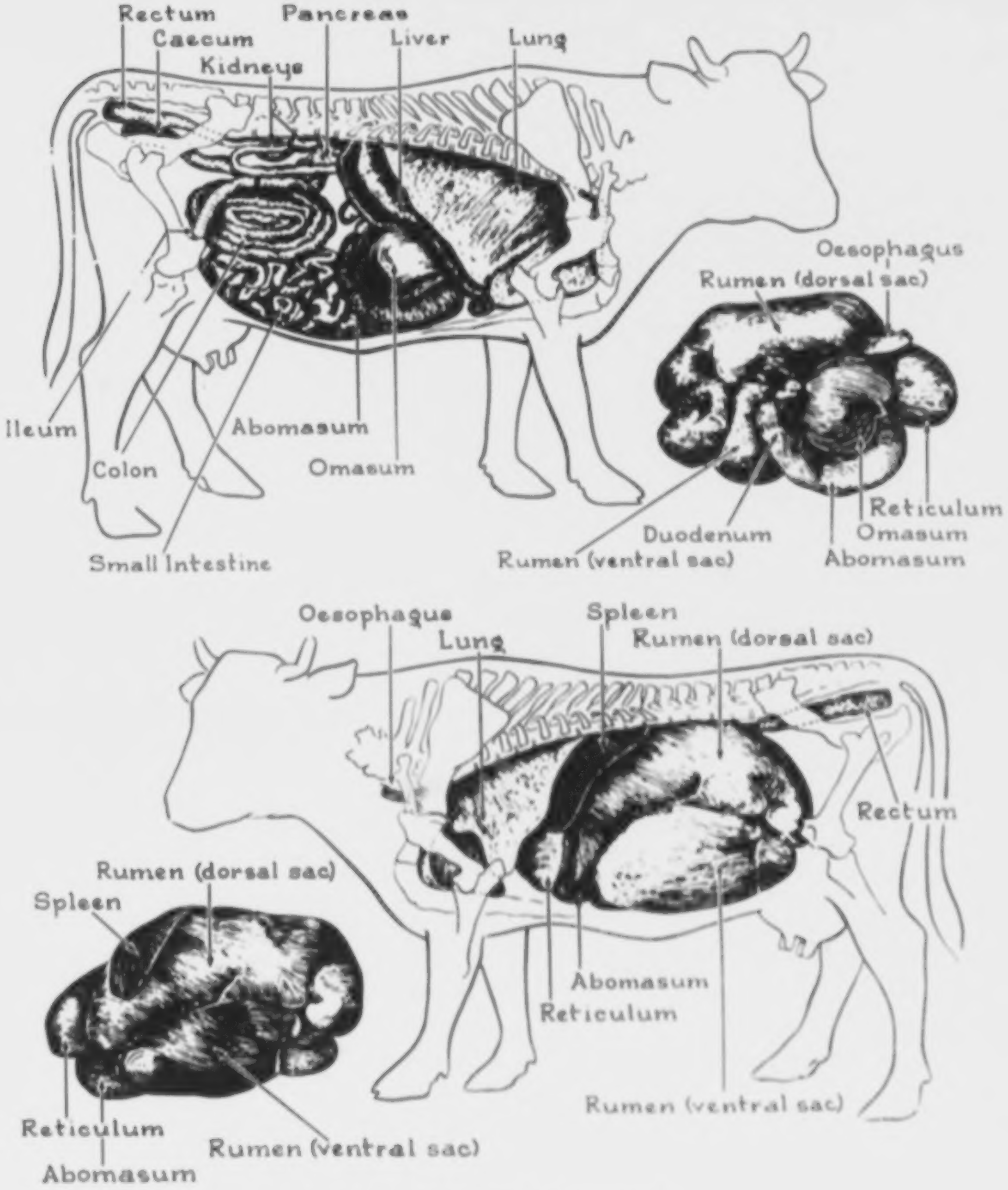


Figure 1-6 Digestive system of the bovine (cont'd).

recovers oxygenated blood through the left atrium to the left ventricle. The left ventricle pumps the blood through the dorsal aorta and its branches to the tissues of the body. The portal circulation system drains blood from the digestive tract and carries it via the portal vein to the liver. The *arteries* are the vessels that carry the blood away from the heart. An example is the femoral artery, which carries blood to the pelvic region. Small arteries are called *arterioles*. Capillaries are very minute vessels, which are extensions of both the arterioles and venules. These minute vessels form a network in the tissues. *Veins* are vessels that carry the blood back to the heart from the body. They have thin walls and valves to prevent the backflow of blood. An example is the jugular vein, which returns blood from the head to the heart.

The Lymphatic System. The lymphatic system consists of lymph, lymph vessels, and lymph nodes. Refer to figure 1-8 as we discuss this system.

In the lymph system, lymph fluid is very similar to

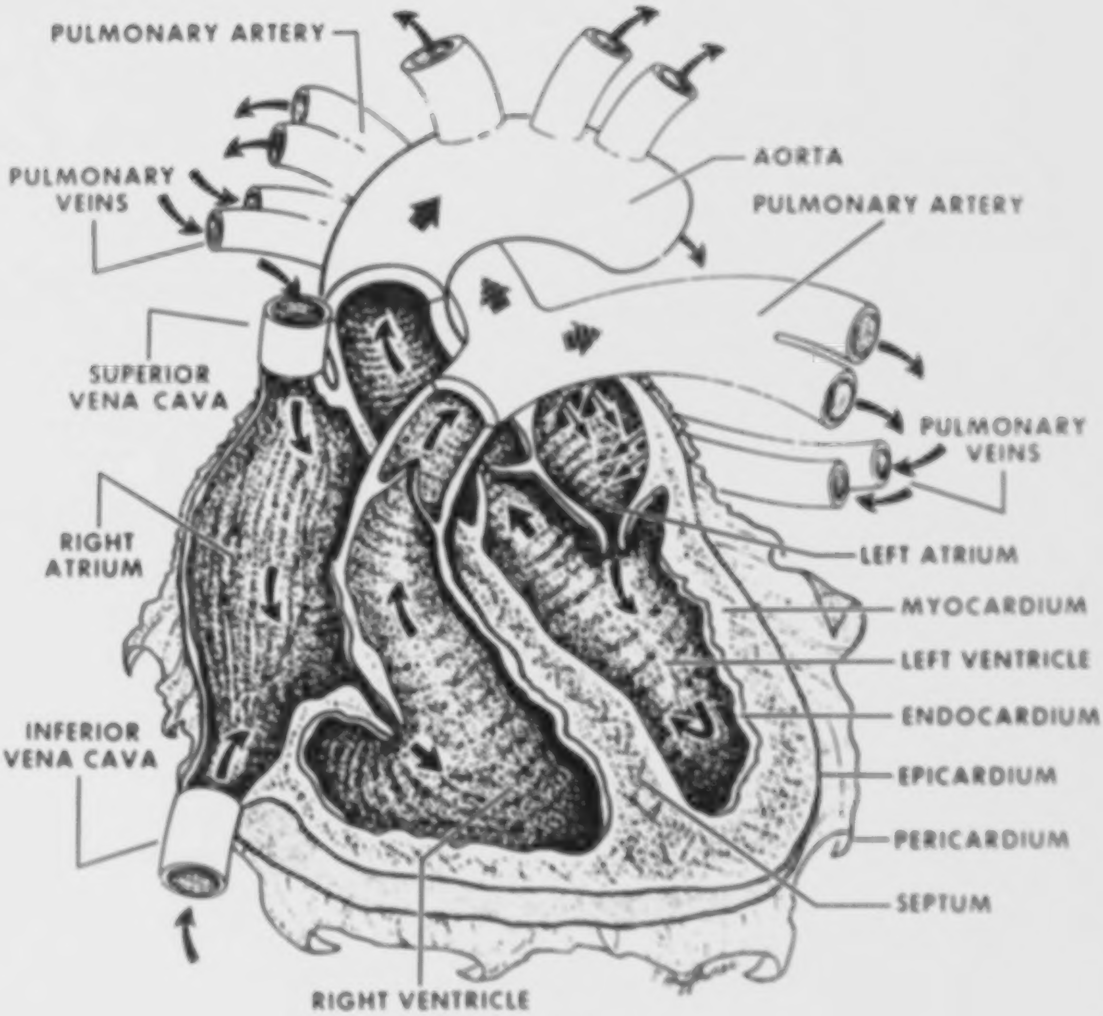


Figure 1-7 Heart.

blood plasma. It is derived from blood and contains white blood cells but no red blood cells. Lymph carries food to individual body cells and remove their wastes.

An intricate system of lymph vessels can be found in nearly every part of the body, except in muscle fibers, nerves, and blood vessels. The flow of lymph through vessels is influenced by differences in pressure, by muscular movements, and by valves that limit the lymph fluid flow to one direction.

Lymph nodes are generally oval shaped and are located along the course of lymph vessels. They serve as "filters" in the system and as such tend to collect disease-producing organisms. They are examined closely during meat inspection procedures. Close examination of lymph nodes can reveal tuberculosis and other abscess-forming diseases.

Respiratory System. The main parts of the respiratory system are the *nasal cavity, pharynx, larynx, trachea, bronchi,* and *lungs.* The exchange of carbon dioxide for oxygen takes place in the lungs. The carbon dioxide is exhaled, and the oxygenated blood is returned to the left atrium of the heart for circulation to tissues of the body.

Urogenital System. This system contains the organs of the urinary and the reproductive tracts.

Urinary tract. The urinary tract is composed of the *kidneys;* the *ureters,* tubes which drain the kidneys; the *bladder,* which stores the urine; and the *urethra,* which is the tube through which urine is finally excreted.

Reproductive tract. In the female, the tract consists of *ovaries, fallopian tubes, uterus,* and *vagina.* In the male, the tract consists of the *testes, vas deferens, prostate, seminal vesicles,*and *penis.* Organs in the reproductive tract are concerned with the production of offspring by a sexual process. Adult animals that have not been castrated and animals with undescended testicles impart a strong, undesirable odor and taste to the muscle tissue. This defect is especially noticeable in pork.

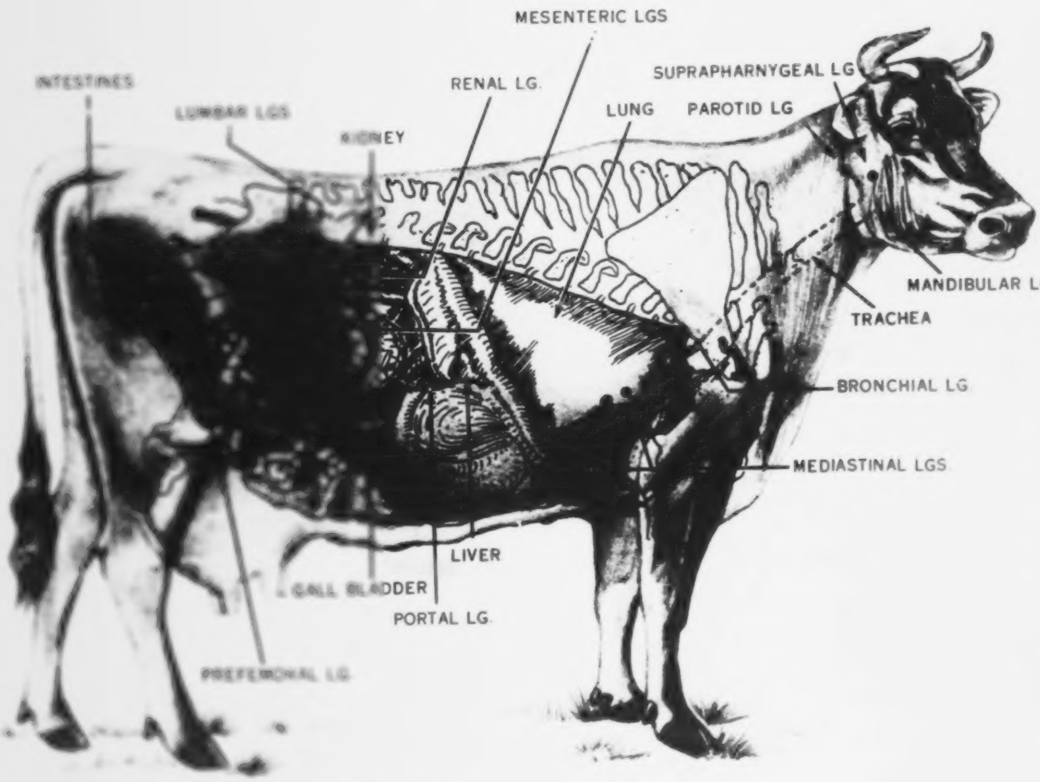


Figure 1-8 Location of the lymph glands.

Exercises (601):

1. Match each system in column B with its related function(s) i column A. Column B letters may be used more than once.

Column A

___(1) Causes voluntary and involuntary body motion/movement.
___(2) Has specific parts that act as beams to support the animal body.
___(3) Breaks down food by means of mechanical action and enzymes to make them usable by the body.
___(4) Carries food and oxygen to body cells.
___(5) Provides body movement through joints.
___(6) Determines reactions to specific stimuli or sensations.
___(7) Returns waste products to excretory organs.
___(8) Stores and excretes urine.
___(9) Contains nodes which serve as filters in collecting disease-producing organisms.
___(10) Produces offspring by means of a sexual process.
___(11) Exchanges inhaled oxygen for carbon dioxide, which is exhaled.

Colum B

a. Digestive.
b. Circulatory.
c. Skeletal.
d. Urogenital.
e. Muscular.
f. Nervous.
g. Lymphatic.
h. Respiratory.

Answer questions 2 through 16 in the spaces provided:

2. Into what three major components is the skeletal system divided?

793 3. List the five regions (or divisions) of the vertebral column.

4. Name the two limbs included in the appendicular skeleton.

5. What bone is revealed by spliting a beef carcas in the middle and exposing the symphysis pubis?

6. List the three types of muscle tissue.

7. What are the two main classifications of muscles—those under conscious control and those not under conscious control—called?

8. Give an example of (a) a tough and (b) a tender muscle, respectively.

9. What are the two main divisions of the nervous system?

10. Label the five main organs in the digestive system alimentary canal.

11. What four organs are included as accessory organs in the digestive system?

12. What are the three principal components of the circulatory system?

13. Name the three subsystems making up the blood vessels.

14. What are the three principal components of the lymphatic system?

15. Give six main parts of the respiratory system.

16. What two tracts make up the urogenital system?

602. Pair the names of various anatomical structures in poultry with statements describing their characteristics or functions.

Poultry Anatomy. The anatomical structures of the chicken have practically the same nomenclature and functions as those of other vertebrate animals. We will emphasize basic species variation for each system.

Skeletal system. The skeletal system in poultry as in other meat species is divided into an axial and an appendicular skeleton (fig. 1-9).

Axial skeleton. The axial skeleton of poultry includes the *skull, vertebral column,* and *sternum.* The skull consists of two large orbits surrounding the brain. The bones of the face form a somewhat sharp and pointed cone. The vertebral formula for poultry is $C_{14}T_{7}L\&S_{14}C_{6}$. Note that birds have considerably more cervical, lumbar and sacral vertebrae, and fewer thoracic and coccygeal vertebrae than do members of the bovine species. The lumbar and sacral vertebrae are fused, and the pelvic girdle is joined to these fused vertebrae. The coccygeal vertebrae, at their anterior end, are attached to the sacral mass. A few posterior coccygeal vertebrae are fused to form the *pygostyle.* The sternum (also referred to as the ("keel bone") is quite large in relation to other bones of poultry. This is due to the attachment of the large flight muscles to this bone.

Appendicular skeleton. Bones included in the appendicular skeleton are grouped into a thoracic and a pelvic limb. The thoracic limb includes the digits, metacarpals, ulna, radius, and humerus, which form, what is commonly called the *wing;* and the scapula, coracoid, and clavicle (wishbone), which form the shoulder girdle. The pelvic limb of poultry includes the pelvis, femur, tibia (drumstick), fibula, metatarsus, and digits.

Muscular system. The muscular system in birds is suited to the special needs of flight. Two major muscled types are found in poultry: the *light* or *flight* muscles and the *dark* or *walking* muscles. The variation in the color of the muscle in poultry is directly related to the amount of oxygen supply required to support flight.

Digestive system. There are some differences between the poultry digestive system and that of the other meat animals we have previously discussed. For example, poultry do not have teeth; food is masticated in the muscular stomach, known as the *gizzard.* Continuing our comparison with higher vertebrate digestive systems, here are the various organs of the avian digestive system and their functions: (1) mouth—has no teeth, lips, or cheeks, and the jaws are curved to form a beak that is used to pick up food; (2) esophagus—connects the mouth with the proventriculus or glandular stomach; (3) crop—a saclike structure used for food storage;(4) stomach—poultry has two stomachs: the proventriculus or true stomach and the gizzard or muscular stomach that is used to masticate or grind foods; (5) small intestines—most digestion occurs here; (6) ceca—two blind scs approximately 7 inches long which empty into the intestine at the junction of the large and small intestine—an area that has been found to be a reservoir for salmonella in poultry; (7) colon—equivalent to the bovine's large intestine, the last part of the tract used in food digestion; and (8) cloaca—common to both the digestive and reproductive tracts, the cloaca opens to the outside through the vent or anus.

Respiratory system. Due to the similarity in the respiratory system of poultry and other meat species, we will mention a phenomenon found only in poultry. This specialization of the respiratory tract is the presence of

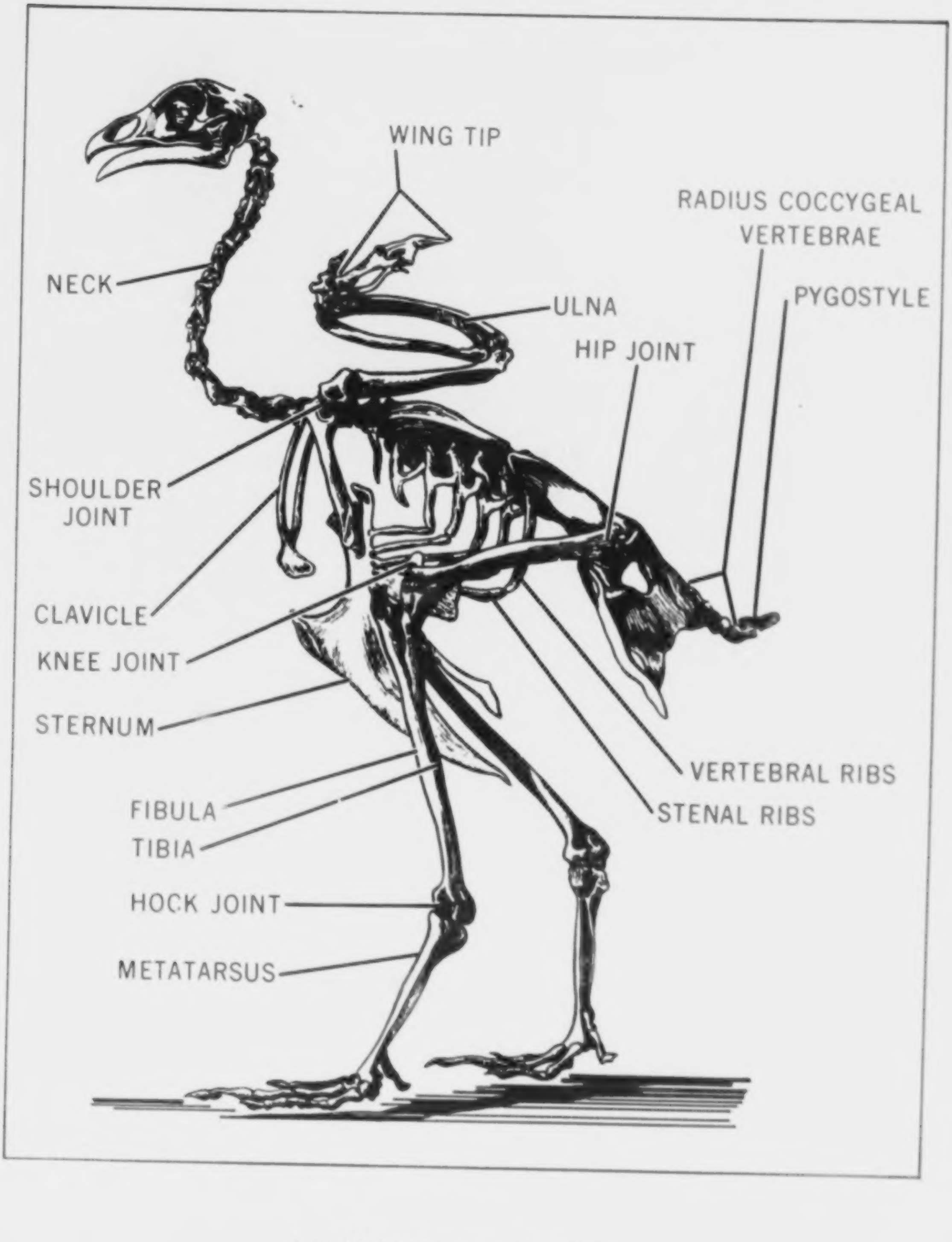


Figure 1-9 Skeletal structure of the chicken.

extensive *air sacs*, which are air-filled spaces connected with the air passages of the lungs. These are found within the long bones, inside the body cavities, and between muscles. Air sacs may become contaminated during processing, with the contamination spreading to other internal body tissues. These air sacs function as an additional air supply and provide bouyancy during flight.

Integumentary system. The integument on poultry includes the feathers, vestigial feathers (hair or down), pin feathers (immature features), and oil glands, which are located in the skin above the pygostyle.

Exercises (602):

1. Match the anatomical structures in column B with correct descriptive statements in column A. Some column B responses will not be used.

Colum A

- ___ (1) Skeleton including skull, vertebral column, and sternum.
- ___ (2) Bones grouped together in the appendicular skeleton.
- ___ (3) Muscular stomach used to grind food.
- ___ (4) System made up of light and dark tissues related to oxygen supply required for flight.
- ___ (5) Saclike structure in digestive system used for food storage.

Colum B

a. Gizzard.
b. Axial.
c. Thoracic and pelvic limb.
d. Crop.
e. Cloaca.
f. Air sacs.
g. Muscular.

1-2. Food Processing Technique

In this section, we will look at some of the general procedures involved in determining how a particular food animal will be classed, graded, or styled for military procurement. At the same time that you read about the ways in which the United States Department of Agriculture (USDA) performs its inspection procedures in this area, you will also be learning what the terminology associated with food processing actually means; i.e., what a particular term allows a food animal to be transformed into.

Meat inspection in the United States is an important responsibility simply because of the large volume of meat procured and consumed each year. There are many levels of inspection and many types of inspection for all meat products intended for human consumption.

The many federal agencies that provide inspection services to the food industry will also be discussed in this section. However, we will not cover the slaughtering of these animals, because the procedure and the inspection at this level is something you can neither control nor change. Also, you will not, as Air Force food inspectors, become involved with this level of inspection. You role is to insure wholesomeness and contract compliance at points of destination. In order to do so, you must understand the system and the language used in grading the various animals after slaughter.

603. Classify beef carcasses by class and state classification requirements concerning sex determination.

Class. *Class* in beef inspection refers to the sex of the animal. The three classes we shall consider are steers, heifers, and cows. Bull and stag carcasses are excluded from procurement. Since class is a specification requirement and may be specified in a procurement contract, determining carcass sex is a necessity during inspection.

Class 1. Belonging to this class are male beef animals castrated before reaching sexual maturity. Commonly called *steers*, these animals are castrated to prevent the undesirable development of secondary sex characteristics. The development of these characteristics (most evident in bull and stag carcasses) yields a carcass with dark red color of lean, with scarce yellow fat deposits, and with large deposits of connective tissue, which causes the lean to be tough.

Class 2. Animals in this class are female bovines, called *heifers*, that have not reached sexual maturity. The lean and bone characteristics are much like those found in a steer carcass. The evidence of youthfulness and the lack of secondary sex characteristics make heifers and steers most desirable.

Class 3. This class includes the mature female or cow. These animals exhibit many of the quality characteristics found in heifers and steers but are more mature. The conformation is more angular than blocky, but these animals are often desirable.

Sex Determining Factors. Sex must be determined by examination of the carcass during inspection. There are four areas (fig. 1-10) that can be examined on each hindquarter to determine the sex or class of an animal.

Pizzle eye. If the carcass is split exactly in half, the *pizzle eye*, or remnant of the attachment of the penis, will be visible just posterior to the aitchbone in male carcasses only. The pizzle eye is normally 1/2 inch in diameter, but it may be larger in bull carcasses.

Pizzle eye cap. The lean muscle surrounding the pizzle eye is the *pizzle eye cap*. This muscle is found only in male carcasses and gives the posterior end of the aitchbone a different appearance in each sex. In the female there is fat at the posterior end of the aitchbone, since there is no pizzle eye nor pizzle eye cap.

Gacilis muscle. Splitting the carcass exposes the *gracilis muscle* in the hindquarter. This muscle extends from the cod or mammary fat to the posterior end of the aitchbone. In the past, the shape of the gracilis muscle has been used in determining the sex of an animal carcass. However, this method is not as accurate as the pizzle eye-pizzle eye cap method, and, therefore, is not used much today.

Udder and cod fat. The *cod* fat is found in males while *udder or dug fat* is characteristic of females. Cod fat is a rough, knobby fat of the scrotal sac of steers. The dug fat is mammary tissue of cows and heifers. It is smooth in texture and more extensive in heifers and cows.

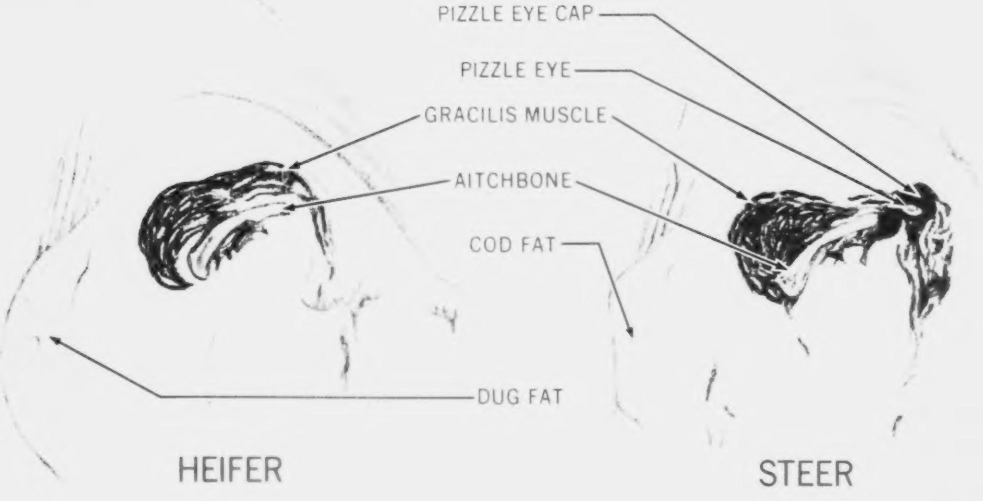


Figure 1-10 Sex determination factors.

Exercises (603):
Identify both the true (T) and false (F) statements on beef carcass classification requirements and sex determining factors in exercises 1 to 6. Explain why those you select as false are false and correct each.

_____ 1. The most desirable carcass for use in food production is the class 1 carcass because it exhibits many of the quality characteristics found in heifers and steers.
_____ 2. Class 2 carcass consists of heifers that have not yet reached sexual maturity.
_____ 3. A carcass that exhibits a dark red lean and scarce yellow fat with large deposits of connective tissue would be classified as a class 3 carcass.
_____ 4. It is necessary to understand class, as regards carcass classification, because there is no specification covering the term.
_____ 5. The most accurate method of determining sex in a carcass is to look for the gracilis muscle.
_____ 6. The pizzle eye is located posterior to the aitchbone in male carcasses only.

604. Define terms and state characteristics used in the classification and grading of poultry.

Classification of Poultry. Poultry is classified in various ways for DOD procurement. The initial classification deals with *species*, which includes primarily chickens, turkeys, and ducks. In order to assure standardization of the product, the requirements of each species are further divided into *type, class, style*, and *grade*. To avoid unnecessary repetition, we will cover primarily those types, styles, and classes concerned with chickens and briefly describe the classification of other poultry which differ from chickens.

Type. *Type* refers to the state of refrigeration and duration of storage in the vendor's possession and includes:

Type I—fresh chilled. Birds will be chilled immediately to 36° F (2° C) and maintained at temperatures not higher than 38° F (3° C) nor lower than 28° F (−2° C) until delivered at points of destination, which will be not more than 4 days from the date of slaughter.

Type II—chickens frozen and maintained at 0° F (−18° C) for not more than 60 days.

Type III—chicken frozen and maintained at 0° F (−18° C) for not more than 120 days for export and 180 days for domestic use.

Type IV—frozen special. Chickens are chilled to 38° F (3° C) and then frozen.

Type V—individually quick frozen (IQF) (class 1 and styles 2, 3, 4, or 5 only). These are frozen immediately after being cut up into specified styles.

Class. Class, as it applies to chicken, indicates the age or sex of the birds and includes:

Class 2— broiler—fryers: 9 to 12 weeks of age of either sex.
Class 2— roasters: young birds usually 3-5 months of either sex.
Class 3— stags: male chickens that have not attained full maturity.
Class4— capons: surgically castrated male chickens.
Class 5— fowls (hens): mature female chickens.
Class 6— cocks: old males usually having been used for breeding.
Class 7— rock cornish game hens.

Style. *Style* in chickens refers to the manner of cut in the birds and includes only birds that are ready to cook, which you will normally see noted as *ready-to-cook* (RTC). Styles procured by DOD include:

Style 1—ready-to-cook, whole. These are whole birds with giblets packed inside the body cavity.

Style 2—ready-to-cook, halves (split). This is confined to class 1 chickens. These are style 1 chickens which have been further processed by making a full length back and breast split so as to produce right and left sides.

Style 3—ready-to-cook, quartered. This is confined to class 1 chickens. These are style 2 birds that are further processed by cutting crosswises at right angles to the backbone so as to produce forequarters of all white meat and hindquarters of all dark meat of approximately equal size.

Style 4—ready-to-cook, cut-up. This is confined to class 1 or class 5 chickens. These are style 3 birds that are further processed by cutting into component parts and by packing in the same proportion in which they appear in the carcass: i.e., two wings, two drumsticks, two thighs, two breast halves, two back halves, and one neck with giblets (gizzard, heart, and liver).

Style 5—ready-to-cook, parts. This is confined to class 1 chickens. These include individual package of wings, legs (thighs and drumsticks intact), thighs, drumsticks, breasts, backs, gizzards, hearts, and livers.

Grade. In Federal poultry inspection, there are two terms that you must understand:

a. "US Inspected for Wholesomeness." This term indicates that the product is acceptable *only* from the standpoint of plant sanitation and product soundness.

b. "US Grade _____." This term indicates that the quality of the product has been examined in accordance with Federal grade standards and has been placed in a specific quality category.

In plants under Federal inspection, *all* birds must be "US Inspected for Wholesomeness," but the plant has an option as to whether all, some, or none of its products will be "US Graded." You should remember, however, that DOD procures only USDA A chickens.

Exercises (604):

1. Give term which indicates that a product has been inspected and found acceptable by the USDA only from the standpoint of plant sanitation and product soundness.

2. What is the term indicating that a product has been placed in a specific quality category according to Federal grade standards?

3. In the classification of poultry, on what are (a) type, (b) class, and (c) style based?

605. Define the types of forms used in the military classifications of fish.

Identification of Fish. Fish are procured for military use under Federal Specification PP-F-381. This document will be your guide to the acceptable quality level and the form of procurement. It classifies fish into types and forms.

Type. Type refers to the method of preservation. The specification classifies fish into two basic types:

Type I—chilled. Categorized here are those fish marketed in a chilled state and which have not been previously frozen.

Type II—frozen. This label tells you that the fish will be solidly frozen when you see it. Fish may be frozen either plain or with an ice glaze.

Form. The cited specification also lists these six forms in which fish are supplied to the user:

Form I—whole or round (not dressed). When a fish is supplied to the market without being cleaned (gutted) or beheaded, the trade refers to them as "in the round." This expression means that the viscera, heads, fins, and tail are intact. Buyers must do their own procession.

Form II—dressed. This form varies in accordance with the type of fish and how it is prepared for market. It may not be the same degree of processing in all cases, because some fish do not require descaling or skinning.

Form III—fillets (single or butterfly). This is the market form for some of the smaller fish. The edible, meaty part of the fish is sliced free from the bony structure and is further processed int this form. A fillet is a side of flesh, cut away from either side of the fish along the backbone from behind the pectoral fin back to the tail section. If the part of the flesh that forms the wall of the visceral cavity remains with the fillet, the fillet is called a *fullnape fillet*. Most high-quality fillets do not contain the nape. Fillets are generally marketed in three ways:

a. Skin on—the skin of the boneless fish flesh is lefton, as in ocean perch or whiting.

b. Skinless—the skin is removed, as in cod, pollock, and certain flat-fishes.

c. Butterfly—two fillets are left fastened together by the uncut skin of the belly.

Form IV—steaks. This is the manner of dividing into marketable portions large, meaty fish, such as salmon and cod. The steaks most commonly bought by the Armed Forces are those of halibut, king, and silver salmon.

Form V—chunks. This is a term you will see used for example, with tuna. It means that the edible portions are broken or otherwise divided into small, irregularly shaped pieces.

Form VI—portions. This is the specification label for such popular forms of fish as "fish sticks" or "fingers."

Fish portions are a product developed especially for the Armed Forces. Two important advantages of this product are uniformity in size and reduction of waste.

Exercises (605):

1. What type of fish are marketed in the chilled state?

2. Fish which may be delivered with an ice glaze belong to what type?

3. Identify the form of fish which has not been gutted or beheaded.

4. What is a side of fish, cut away from either side of the fish along the backbone called?

5. What form is a fish steak?

6. What does Form VI in fish refer to?

1-3. Quality and Wholesomeness Assurance

The numerous inspection programs that exist in the United States are designed to protect the American consumer from potential health problems; they also provide a guarantee of quality and standardized portions to those same consumers. The Air Force is no exception as regards the benefits that are derived from these inspection programs. It is important that the food inspector be able to recognize the different seals, stamps, and marks used by these inspection agencies to certify grade and wholesomeness. Equally, if we are to take our task of protecting the health of the military member seriously, we must be able to identify an unwholesome product when it is inadvertently delivered to our facilities.

606. Describe the use of Federal and State inspection agency markings.

Federal Inspection Markings. The Federal Government provides several agencies to the food processor for the evaluation of the sanitation within the processing plant, the wholesomeness of the product being processed, and the quality grades (if such exist for the product) for the products being processed. As a food inspector, you need to have an understanding, and a ready recognition, of these symbols and what each means.

Marks of Wholesomeness. The USDA is the primary food and food plant inspection agency in the United States. As part of the USDA's inspection program, it identifies food processing plants that are operating under sanitary conditions predetermined by the USDA. If the plant does meet the specific operating requirements set by the USDA, its products are marked with a USDA Wholesomeness Stamp (fig. 1-11). The product that is produced within the inspected plant will carry a symbol which indicates that it is being produced in a sanitary environment and that the product is wholesome at the time of stamping and packaging. That is all that stamp means, and to add any other message to it is wrong. The stamp does not imply that the product meets your contract requirements; it does not mean that you don't need to inspect the product for wholesomeness at delivery. The Armed Forces will not purchase any product which is manufactured in a plant that is not inspected by the USDA, or a similar agency; it will not accept a product that has not been preinspected by the USDA for wholesomeness. Keep in mind the types of product that the USDA inspects. Fish and shellfish do not receive USDA inspection; whereas meats, poultry, and eggs *do* receive USDA inspection.

In states that operate their own meat or poultry inspection programs, the State inspection stamp may be the only mark on the product. However, State-inspected products and federally inspected products are required to come up to the same standards. Meat and poultry inspected in a State system, however, can only be sold within that state. Any carcass or its processed products going across state lines or into other countries must be federally inspected.

Armed Forces Inspecting Markings. You are required to identify food products that have been accepted for military use. At each stage of food procurement, someone in the military with the responsibility for food inspection will be marking the food product container with an inspection mark that will serve to tell you, the destination inspector, that the particular product has indeed been inspected by the proper military agency. The US Army is presently involved with the class 3, or "Prior to Purchase" procurement inspection. The Army inspectors will stamp each product that receives, and passes, this initial inspection with a *partial inspection approval stamp*, or PIA stamp. It is similar to your destination inspection stamp (fig. 1-12); its main difference is that the eagle in the stamp is enclosed in a circle, and not a square, as is your stamp. Remember, the PIA stamp means only that the product has been inspected during processing by the US Army and found to conform to that product's specification requirements. It is no guarantee that your products will be wholesome at delivery, nor that they will still be conforming at delivery.

When a product is bought by the Government for long-term storage, as is the case with troop-issue products, then the Army will provide another inspection service to the user—in this case, to you, as the destination inspector. Each product that is sent from a Government warehouse for use at your base will receive another inspection before it is shipped. The Army in-

Marks of Wholesomeness

This official USDA mark for approved meat carcasses is stamped only on major cuts of the carcass, so it may not always be visible on consumer cuts like roasts or steaks:

This mark is on all prepackaged processed meat products—from beef barley soup to frankfurters—that have been federally inspected:

This mark is used on federally inspected fresh and frozen poultry and processed poultry products. Although visible on all consumer-packaged frozen and processed products, the mark may not always appear on fresh poultry which has been bulk shipped and then packaged at the retail level:

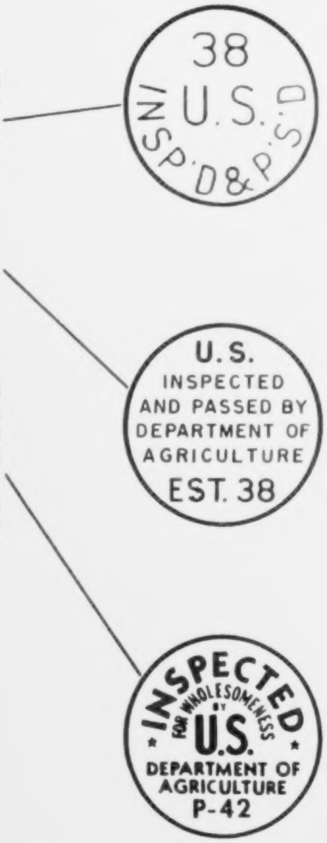


Figure 1-11 USDA wholesomeness stamps.

spector will stamp the shipping containers for all products being shipped to you with an inspector's identification stamp (fig. 1-13). This signifies that the product was inspected for possible damage, wholesomeness deterioration, and correct quantity prior to its shipment from a depot or warehouse. Look for this stamp on all Government-owned subsistence shipments to your base. A lack of stamping on the product containers could indicate potential problems with the carrier, the product, and perhaps with the depot or warehouse itself.

When a product is received at your base, it is your responsibility to inspect it. At the end of your inspection, you are required to make recommendations regarding the products acceptability; i.e., should it be accepted or rejected? You need to mark the vendor's invoice with the results of your inspection.

If you choose to recommend acceptance of the product; i.e., that the product is wholesome and does meet the terms of the contract—then you are required to mark the vendor's invoice, *each* copy, with your destination inspection stamp, or the complete inspection approval stamp (fig. 1-12). The imprint of the CIA on a vendor's invoice informs your base purchasing and contracting office (PCO) that the vendor should be paid for that delivery. The product was wholesome, in good condition, and of the quantity specified when ordered. You, as a representative of the Air Force, are saying that you have found the product acceptable and are recommending that it be accepted by the base PCO. Do not be too casual with this responsibility. You are spending the Government's money every time you recommend acceptance of any product.

After a product is accepted by the PCO, or whomever the ordering officer might be, it may be necessary to warehouse it for future use. This is most always the case when we discuss troop issue subsistence. As a food inspector, you'll be performing surveillance inspections on warehoused subsistence in order to provide up-to-date information on the condition and usability of subsistence being stored in base warehouses. We'll be discussing the actual inspection procedure for surveillance inspections later on in this volume. For now, you need to see that it is customary to mark the product containers in order that warehouse personnel can identify and issue subsistenced items that are the oldest and that require use immediately. Your job involves determining which items require immediate issue, which may be stored for a longer period of time, and which are not being used at all and should be removed from the ordering lists to prevent loss of money.

In large depot-type environments, this program of

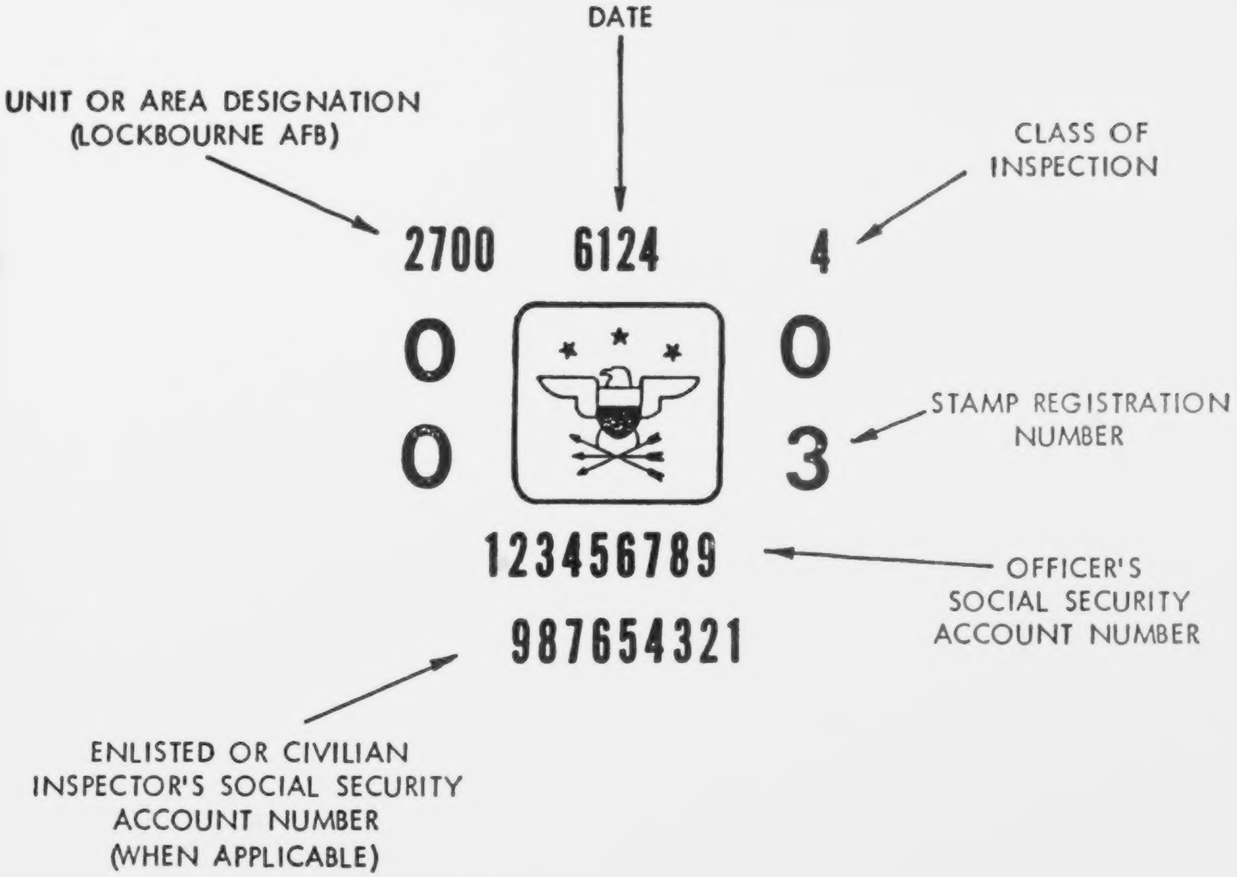
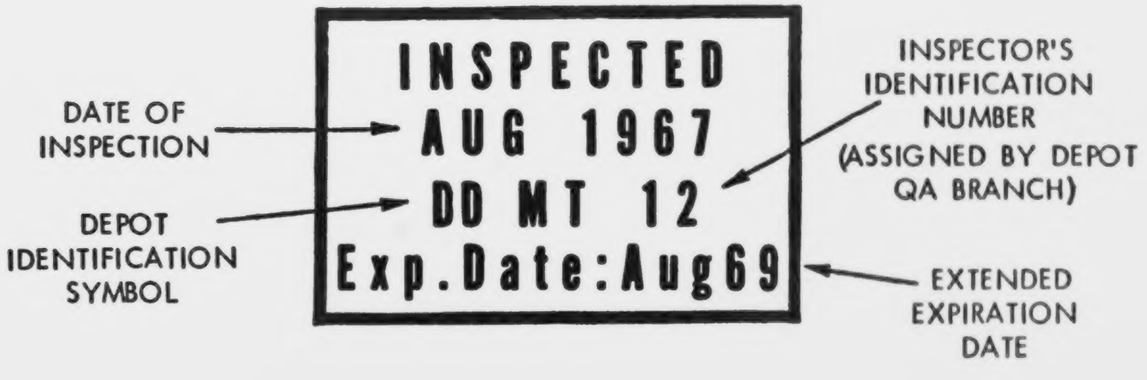

DATE
UNIT OR AREA DESIGNATION (LOCKBOURNE AFB)
CLASS OF INSPECTION
2700
6124
4
0
0
0
3
STAMP REGISTRATION NUMBER
123456789
OFFICER'S SOCIAL SECURITY ACCOUNT NUMBER
987654321
ENLISTED OR CIVILIAN INSPECTOR'S SOCIAL SECURITY ACCOUNT NUMBER (WHEN APPLICABLE)

Figure 1-12 Destination inspection approval stamp (complete).


INSPECTED
AUG 1967
DD MT 12
Exp.Date:Aug69
DATE OF INSPECTION
DEPOT IDENTIFICATION SYMBOL
INSPECTOR'S IDENTIFICATION NUMBER (ASSIGNED BY DEPOT QA BRANCH)
EXTENDED EXPIRATION DATE

INSPECTOR IDENTIFICATION STAMP

Figure 1-13 US Army inspector identification stamp (complete).

surveillance over stored product is difficult; in some, you will find that a product is issued to you with a shelf life that has been long expired. It is true to say that, once you have completed a surveillance inspection, you will be more understanding of the depot personnel and their problems.

Again, the main thing you should know at this point is that at the end of your inspection, you are required to stamp the containers you have inspected (fig. 1-14A and B). This stamp signifies that the product is still fit for its intended use. It also helps the warehouse supervisor to properly rotate the inspected stock, so that it can be used before it becomes unfit.

Other Inspection Markings. The Federal Government is very involved in the inspection and grading of many of our food products. We will, therefore, discuss some areas that are inspected, or graded, by the Government and show you what some of the inspection markings look like that go with these programs.

The Federal or, in this case, USDA inspector will grade the product for the user. Basically, the USDA grader stamps the product, or the sealed carton in which it is contained, with a shield-shaped stamp bearing the words "USDA Accepted as Specified." This assures the purchaser—the Air Force—that all products delivered to the delivery point met the requirements of the specification(s) at the time of inspection. This stamp "says" that the product is wholesome and of the grade, trim, weight, etc. that the purchaser has requested. In our case, the "USDA Accepted as Specified" stamp signifies that the product met the military, or Federal, specification requirements at the time of inspection.

Almost all meat items for military use (other than troop issue) are bought using the institutional meat purchase specifications (IMPS). The USA uses the IMPS as a document for inspection—we use the IMPS as a destination inspection document—and the products you see at your base have met these specified requirements if listed in your contract documents. Take a minute to review figure 1-15; this list of stamps used by the USDA will give you a brief overview of some of the inspection markings used. We do not mean to "downplay" this subject. However, most of your expertise in this area will come from experience, and your best effort should go towards readily recognizing the symbols and seals used by the Federal and State inspection agencies that support our food inspection system.

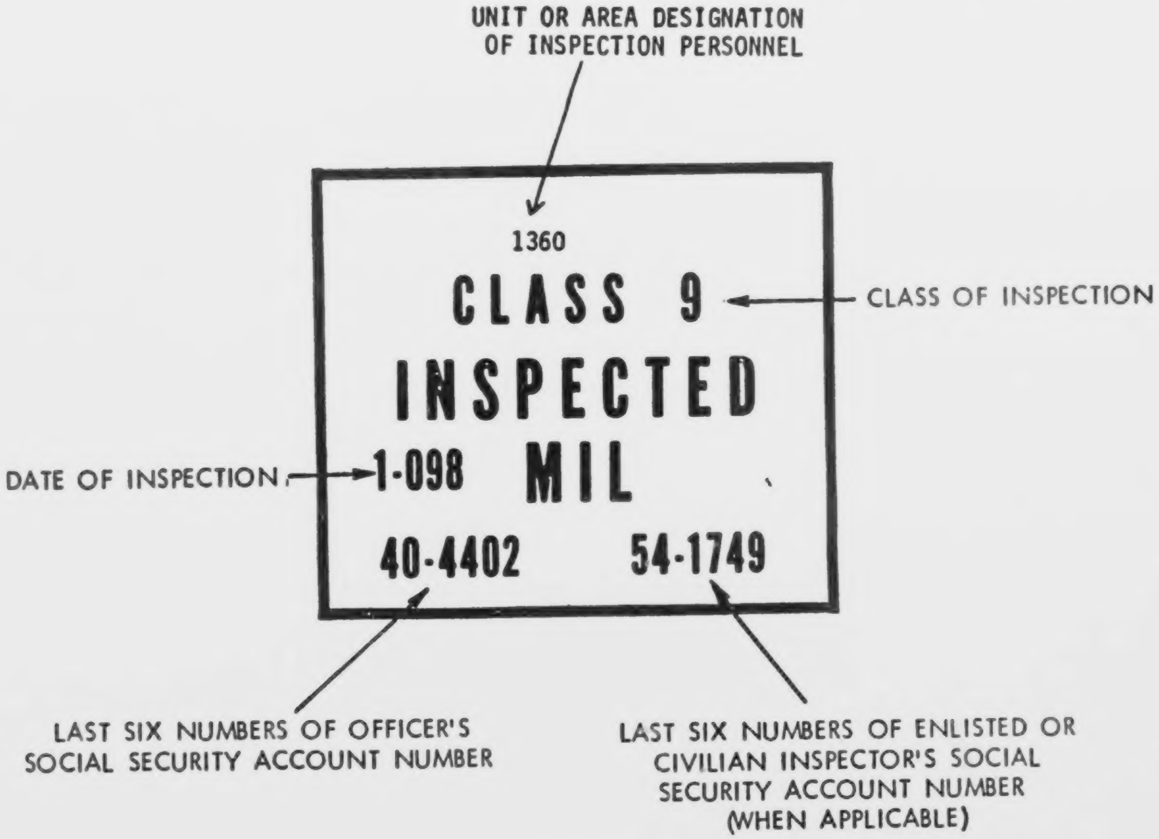

UNIT OR AREA DESIGNATION OF INSPECTION PERSONNEL
1360
CLASS 9
CLASS OF INSPECTION
INSPECTED
DATE OF INSPECTION
1-098
MIL
40-4402
54-1749
LAST SIX NUMBERS OF OFFICER'S SOCIAL SECURITY ACCOUNT NUMBER
LAST SIX NUMBERS OF ENLISTED OR CIVILIAN INSPECTOR'S SOCIAL SECURITY ACCOUNT NUMBER (WHEN APPLICABLE)

Figure 1-14A Surveillance inspection stamp for perishable subsistences.

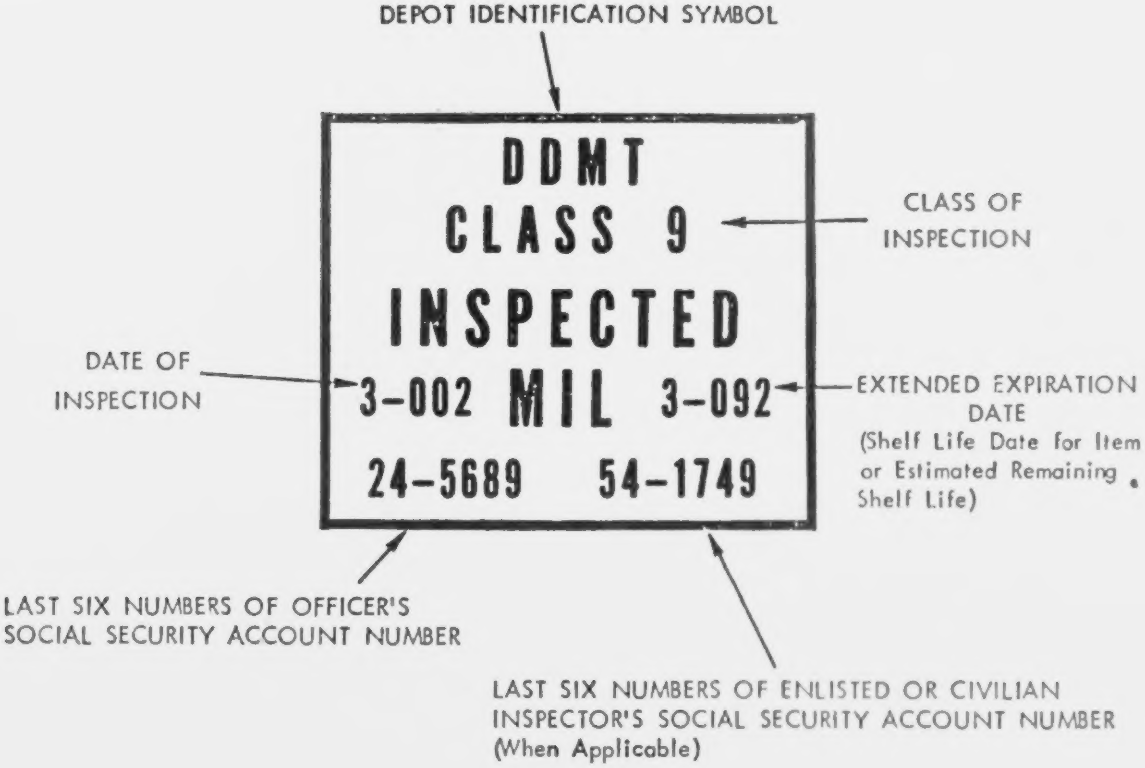

DEPOT IDENTIFICATION SYMBOL
DDMT
CLASS 9
CLASS OF INSPECTION
INSPECTED
DATE OF INSPECTION
3-002
MIL
3-092
EXTENDED EXPIRATION DATE (Shelf Life Date for Item or Estimated Remaining Shelf Life)
24-5689
54-1749
LAST SIX NUMBERS OF OFFICER'S SOCIAL SECURITY ACCOUNT NUMBER
LAST SIX NUMBERS OF ENLISTED OR CIVILIAN INSPECTOR'S SOCIAL SECURITY ACCOUNT NUMBER (When Applicable)

Figure 1-14B Surveillance inspection stamp for semiperishable subsistence.

Exercises (606):

1. What three areas are evaluated when the Federal Government provides inspection services to a food processor?

2. What is implied by a USDA Wholesomeness Stamp on a processed food product?

3. What must occur when State-inspected foods cross statelines?

4. What does the partial inspection approval (PIA) stamp imply?

5. Why do Army inspection personnel affix an inspector's identification stamp to depot foods?

6. When you apply a destination inspection approval stamp to a vendor's invoice, what are you implying?

7. What does a surveillance inspection stamp, applied to a stored product container, imply?

8. What does the "USDA Accepted as Specified" stamp imply?

FEDERAL GRADER ACCEPTANCE

When the purchaser requests delivery, the supplier asks the nearest USDA meat grading office to have a grader examine the product. The meat grader is responsible for accepting the product and certifying that it is in compliance with specifications.

The Federal grader stamps each acceptable meat item, or the sealed carton in which it is contained, with a shield-shaped stamp bearing the words, "USDA Accepted as Specified." This assures the purchaser that all products delivered to him met the requirements of the specifications at the time of acceptance.

This method of meat procurement assures the purchaser of a wholesome product (only meat that has passed inspection for wholesomeness will be examined for "acceptance") of the grade, trim, weight, and other options requested. This system also encourages competitive bidding and usually results in overall lower costs; permits long-range meal planning; and eliminates controversies between the buyer and seller over compliance of product.

COPIES OF IMPS ARE AVAILABLE from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, as follows:

- Institutional Meat Purchase Specifications (IMPS)—General Requirements, 10¢ per copy.
- IMPS for Fresh Beef—Series 100, 20¢ per copy.
- IMPS for Fresh Lamb and Mutton—Series 200, 10¢ per copy.
- IMPS for Fresh Veal and Calf—Series 300, 15¢ per copy.
- IMPS for Fresh Pork—Series 400, 15¢ per copy.
- IMPS for Cured, Cured and Smoked, and Fully-Cooked Pork Products—Series 500, 15¢ per copy.
- IMPS for Cured, Dried, and Smoked Beef Products—Series 600, 10¢ per copy.
- IMPS for Edible By-Products—Series 700, 10¢ per copy.
- IMPS for Sausage Products—Series 800, 20¢ per copy.
- IMPS for Portion-Cut Meat Products—Series 1000, 20¢ per copy.

MARKINGS ON PRODUCTS AND CONTAINERS

Quality Grade Marks

All carcasses and most cuts of beef, veal, calf, lamb, yearling mutton, and mutton will bear a ribbon-like imprint of the applicable quality grade mark.

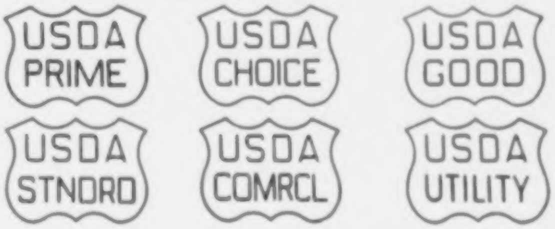


Figure 1-15A Federal inspection stamps.

607. Identify specific USDA meat wholesomeness inspection responsibilities with typical instances of plant inspection procedures.

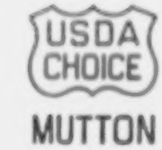
The USDA Meat Inspection Service functions to insure that meat is free of diseases which may be transmitted from animal to man. A subdivision of the USDA known as the "Animal and Plant Health Inspection Service (APHIS)" maintains veterinarian and lay meat inspectors to detect and destroy diseased meats in those plant approved by the USDA. The inspectors actually function in several areas of wholesomeness inspection ranging from plant construction to handling of condemned meats. Products inspected by the USDA, and bearing the proper stamps, are free to move in interstate and foreign commerce.

Plant Approval. USDA approved animal slaughtering and meat processing plants are inspected for proper ventilation, adequate lights, and efficient sanitary systems in accordance with minimum plant construction standards. The plant must also have easily cleaned, rust-resistant equipment and an approved operating technique before approval is granted. If all the necessary requirements are met, the establishment is approved, and inspectors are assigned; the plant is then issued an "Establishment Number" and subsequently listed in the *Director of USDA Approved Plants*. All products leaving the plant must be identified with the establishment number.

Antemortem Inspection. USDA inspectors, accompanied by a representative of the plant, check live animals within the holding pens to detect and eliminate those unfit for slaughter. An animal may be totally eliminated and marked "Condemned" for such conditions as fever, diarrhea, difficult breathing, or coughing. The handling of condemned animals is controlled by the inspectors. Condemned animals must be rendered (the fat cooked out), tanked (cooked for fertilizer or animal feed), chemically denatured, or incinerated. Those animals appearing slightly ill, possibly just weak from the trip to the slaughterhouse, are also separated and marked "Suspect." Suspect animals may be slaughtered at the end of a day's production, if approved by the inspector after a more thorough inspection. Only the animals considered to be wholesome and fit for human consumption are marked "Passed" and slaughtered.

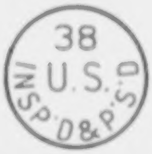
Postmortem Inspection. The animals that are accepted for further processing for human consumption receive a thorough postmortem inspection. The carcass, head, and viscera are closely examined for physiological signs of disease or abnormal conditions, such as abcesses. The USDA inspector has the authority to condemn meat during any stage of processing and to order the correction of unsanitary conditions throughout the establishment. Unfit carcasses are stamped "Condemned" and removed from the processing area, while others are stamped "Passed." Condemnation can be partial or complete, depending upon the type and se-

Class Marks



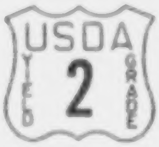
Bull and stag beef and veal, calf, yearling mutton, and mutton are also identified with the class name in addition to the grade. Grade marks applied to lamb and to steer, heifer, and cow beef do not include the class name.

Inspection Marks



Federally inspected meat or containers in which it is packed bear a round Federal meat inspection mark. An inspection mark of a different shape will appear on meat originating in an approved non-federally inspected plant. Inspection stamps indicate that the meat was wholesome and fit for human consumption at time of inspection. Do not confuse the inspection mark with the shield-shaped quality grade mark shown above.

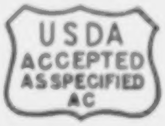
Yield Grade Marks



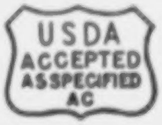
If a USDA yield grade is specified, a mark similar to the one on the right will appear on carcasses or wholesale cuts of beef, lamb, yearling mutton, or mutton. Yield grades identify carcass differences in yields of boneless, closely trimmed retail cuts. Yield Grade 1 represents the highest yield of retail cuts; Yield Grade 5, the lowest yield.

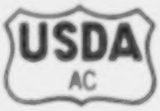
Acceptance Stamps

In addition to inspection marks and grade marks, one or two other stamps appear on USDA-accepted products.



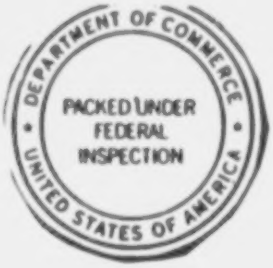
CHILLED PRODUCT — The imprint of the USDA Accepted as Specified stamp will appear on all products that can be individually stamped or on the carton if the product can not be individually stamped. When this stamp is applied to containers, it will be placed over the sealing tape on the container and over the grade name in the lower left corner of one end of the container. (The letters AC in the example are a code to identify the grader who accepted the product.)

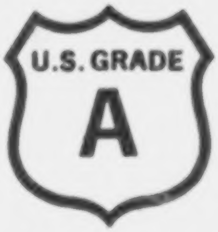




FROZEN PRODUCT—All products that can be individually stamped will bear the USDA Accepted as Specified stamp. In addition, all containers will bear the stamps shown at the right. These will be applied as follows: The USDA Accepted as Specified stamp will be applied over the grade name in the lower left corner of one end of

Figure 1-15B Federal inspection stamps (cont'd).





"U.S. GRADE" MARK. The "U.S. Grade" mark signifies that:

1. The product is clean, safe, and wholesome.
2. The product is of a specified quality, identified by the appropriate U.S. Grade designation, as determined by a Federal Inspector.

PACKED UNDER
FEDERAL
INSPECTION

U.S. DEPARTMENT
OF COMMERCE

"PACKED UNDER FEDERAL INSPECTION" MARK. "Packed Under Federal Inspection" may be displayed as an official mark or as an official statement on the product label. The mark or statement signifies that the properly labeled product is clean, safe, and wholesome and has been produced in an acceptable establishment with appropriate equipment under the supervision of Federal inspectors. The product has not been graded as to a specific quality level; rather, it is an acceptable commercial quality as determined by Federal inspectors in accordance with approved standards or specifications.

Figure 1-15C Federal inspection stamps (cont'd).

verity of the disease. For example, complete condemnation is in order with such conditions as anthrax or backleg; while partial condemnation of the affected organ or tissue may suffice if tapeworms or bruises are detected. Also, of unsanitary conditions develop in any area of the plant, the inspector places a "Rejected" or "Retained" tag on the equipment or area in question. The tag is removed by the inspector only after cleaning and reinspection of the area.

Products Inspection. Surveillance is maintained throughout all aspects of cutting, boning, grinding, curing, cooking, and smoking. Each process is carefully examined for sanitation and proper handling procedures. Close attention to proper temperatures is important in preventing spoilage and insuring proper cooking. Ingredients and additives for each product are also checked and approved by the inspector. Raw materials used, as well as the end product, must be wholesome. The inspector has the authority to reinspect any item that may become sour or rancid during processing or holding. Product wholesomeness is the inspector's primary goal, and all possible points of contamination are that person's concern.

Labeling and Laboratory Control. Inspectors use seven laboratories to analyze meat products under the "US Retained" tag. All ingredients must be safe for consumption (nontoxic) and must be in the amounts specified. Packaging and packing material must also be nontoxic. During processing, adulteration is a constant concern of the inspector to guard against the addition of excess fat or moisture, the use of undesirable animal tissues, such as horse meat, or the inclusion of insecticides, antibiotics, estrogenic residues, or other undesirable or harmful foreign materials. Prior to using additives in meat products, approval must be granted by the USDA according to criteria set forth under the Food, Drug, and Cosmetic Act. Additives which are acceptable and the amount which may be used are listed by the USDA; only those appearing on this list may be included in a product. The labels are approved and verified, so as to assure the name of the product, its ingredients (in descending order of contents), the unit weight or quantity, and the "Establishment Number" inspection legend. Ingredients are the most important area on the label, and USDA inspectors must draw samples for laboratory analyses to insure proper labeling.

The Wholesome Meat Act. The passing of the Wholesome Meat Act, 15 December 1967, allowed the military to procure from State-inspected plants. The law directs all State inspection systems to become "equal to" or more stringent than the Federal (USDA) system. To be eligible to sell their products to the US Armed Forces, State-inspected meat establishments must have consumer health protection and safeguards that equal those provided by the Federal inspection systems. The State inspection system is evaluated and approved by the USDA. This department also assigns and awards contracts. Products from State-inspected meat establishments can now be exported or shipped across State liens and in foreign commerce. One additional requirement is made by the military: any plant being considered for a contract must certify compliance with Public Law 85-765, the Humane Slaughter Act, dated 27 August 1958. This law simply states that meat sold to the Federal Government must be slaughtered humanely. USDA inspection of poultry plants is very similar to that of red meat plants.

Exercise (607):

1. Match the USDA responsibility in column B with the statements listed in column A by placing the letter of the column B item in the space provided in column A. Each item in column B may be used once or more than once.

Column A

_____(1) Initial inspection of a proposed meat processing plant.
_____(2) Inspection of the liver for abscesses.
_____(3) Inspection of sausage grinders after cleaning.
_____(4) Evaluation of contents of a can of chopped ham.
_____(5) Requires USDA approval of State-inspected meat plants.
_____(6) Determining the moisture content of a frankfurter.
_____(7) Examining animals as they are off-loaded into holding pens.

Column B

a. Plant approval.
b. Antemortem inspection.
c. Postmortem inspection.
d. Products inspection.
e. Proper labeling and laboratory control.
f. Wholesome Meat Act.

608. Explain terms associated with specification or fabricated beef inspection

Definition of Terms Related to Beef Inspection. The specification for fabricated beef requires examination of the end item for product characteristics. The terms used in describing these characteristics are common rather than scientific and are defined within the specification. Here we briefly define each term and give the requirement for individual style.

Surface fat. The fat found on external surfaces of the carcass or individual cuts is called *surface fat.* Reasonable amounts of surface fat are required for higher quality carcasses, but during boning and trimming, excess or waste fat is removed. The specification permits 1/2 inch of surface fat in all styles of fabricated beef and allows *bridging* of fat pockets. Bridging involves placing a ruler across fat pockets extending into the lean and measuring from the ruler to the outside surface. This measurement may not exceed 1/2 inch, and the width of the fact pocket cannot exceed 1 inch.

Seam fat. The *seam fat* in carcass beef is found surrounding lymph glands and inside natural seams of muscles. Since it lies between muscles, the term "intermuscular fat" is often used to describe seam fat. The normal fabrication of carcasses will cause seam fat to appear as surface fat on many cuts; therefore, the trimming requirement is also 1/2 inch for seam fat.

Semiattached fat (tag end). This kind of fat, which may also include muscle and connective tissue, is an example of poor workmanship. The allowance for such tissue is not to exceed 1 inch in length; the tissue must support the weight of the cut if raised by the distal one-third of the *tag end.* The occurrence of tag ends has been decreased by requiring additional trimming of certain small muscles, such as the multifidus dorsi on loin strips. This trimming prevents the slightly attached muscle from separating during processing and thus becoming a tag end.

Bruise. Bruises indicate damaged muscle tissue, caused by rough handling of animals prior to slaughter or any severe blow to the animal. The connective tissue becomes opaque, and the muscle is darkened by loss of circulation in an area. The specification limits bruises to no more than 1 inch in any dimension.

Blood clots and spotters. The *blood clot* is an opaque mass of coagulated blood. It may appear in surface fat or muscle tissue as a result of a clotting reaction during slaughter. The dimensions should not be more than 1/2 inch in any direction. The *spotter tissue* often seen in carcass beef is a ruptured blood vessel, which is normally a burst capillary that occurred during slaughter. This tissue appears as hemorrhages rather than clots of coagulated blood in fabricated cuts.

Bone and cartilage. The gristle or elastic connective tissue of cartilage is unossified or not hardened as bone tissue. *Bone or cartilage* may be evident on cuts removed from joints, directly off bone surfaces, or any area of attachment for muscle to bone. The length of either of these may not exceed one-quarter of an inch.

Cut and fractures. The *fracture* is any crack penetrating more than one-half the thickness of a frozen steak. Fractures result from rough handling of frozen products, while *cuts or scores* occurr during boning and trimming. Poor workmanship in fabrication can result in large cuts on roasts or steaks. The allowance is 1 inch in depth and not more than 2 inches in length or width.

Finished Product. The end item should be free of any foreign materials or foreign odors. The condition should remain excellent as in the raw materials, showing no discoloration, sourness, rancidity, freezer burn, or dehydration. Defects defined in the specification, such as bone, cartilage, bruises, blood clots, excess fat, or deep cuts, must be removed and excluded from the end item.

Exercises (608):

1. What does "surface fat" refer to in specification beef?

2. What are the requirements for surface fat on fabricated beef?

3. What does "seam fat" refer to in fabricated beef?

4. What are the requirements for seam fat in fabricated beef?

5. What does "bruise" refer to in fabricated beef?

6. What does "cut and fracture" refer to in fabricated beef?

609. Cite terms and procedures associated with the grading of veal and calf.

Grading Veal and Calf. Veal and calf carcasses are graded on a composite evaluation of three grading factors: *conformation, quality,* and *finish.* These factors are given the same proportionate value in grading when grading veal, calf, or mature beef.

As with beef, we are concerned with the proportions of the various wholesale cuts in the carcass, and especially with the fleshing of those areas that provide the most valuable cuts. Standard grades for veal and calf are Prime, Choice, Good, Standard, Utility, and the military equivalents of A through E, based on the grading factors.

Conformation. *Conformation* refers to the general form, build, shape, or outline of the carcass, with special emphasis on the amount of flesh in those areas, such as the legs, loins, and ribs, which are the more expensive cuts. The best conformation involves a blocky compact body, short shanks, thick, full, plump rounds, a well-developed and broad back, thick shoulders and and flanks, and a short, stocky neck. Ideal conformation is found in the beef breeds.

Quality. *Quality* of meat refers to is indicated palatability. It is evidenced by the texture, firmness, and color of the flesh. These factors are most obvious in exposed muscle surfaces, such as the gracilis muscle, the fold of the flank, the rib muscle, and the brisket. The color factor is most important because of its variation. For example, if a carcass is chilled too slowly, the color will be darker. other conditions influencing color are age, diet, and resting prior to slaughter.

Finish. *Finish* is the amount, character, and distribution of fat in a carcass. The nubbin consists of the prefemoral lymph gland and its surrounding fat and is used as one indicator of finish. In unskinned animals, the nubbin can be felt in the fold of the flank.

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Internal fat. The higher grades of calf and veal usually have moderately large deposits of fat in the pelvic region and around the kidneys, flank, breast, and crotch. Feathering and marbling are found in the larger, well-fed calves.

External fat. The top grades of veal require a thin covering of fat over the rump, loin, back, and shoulders. In young, lighter animals, the covering is softer, more pliable, and thinner. In order animals, it becomes harder, flakier, and much heavier or thicker. The amount of external pelvic and kidney fat is given no consideration in Prime and Choice grades.

Lack of fat. The lack of fat in veal and calf carcasses is called a *burned-out appearance.* Cold weather and undernourishment cause this condition. It is a lack of internal fat, and the fat that does exist appear dark brown. This appearance of fat is particularly noticeable around the kidneys.

For a review of the characteristics within the individual grades refer to table 1-1.

Refrigeration. Veal and calf are purchased in two states of refrigeration—chilled and frozen. At the time of delivery, frozen items must show no signs of thawing and refreezing and must have an internal temperature of not higher than 10° F(−12°C) if for export use and 15° F(−9° C) if for domestic use. Chilled items must have a temperature of not more than 45° F(7° C) at time of delivery. Products which exceed these temperatures should be rejected. In those cases where the product exceeds the required temperature, but the delivery temperatures is not more than 5°F higher than that required, the contracting officer may authorize the vendor to rework the product. In order for the contracting office to authorize this rework, the product must meet all other contract terms. If the rework is authorized, the vendor must immediately reduce the temperature and reoffer the product. The temperature at the time of the reoffer must be no higher than 5° F(−15° C) for frozen products for export, 10° F(−12° C) for frozen products for domestic use, and 40° F(4° C) for chilled products.

Specification Classification. In DPSC inspections, both veal and calf carcasses are referred to as "veal"; however, calf carcasses are not often offered for DPSC contracts. During the classification phase, the specification differentiates these animals by sex, item, and weight range. Because the DPSC inspection is not concerned with sex determination, we do not discuss sex differentiation here.

Item. *Item* refers to the method or manner of cutting the carcass. The institutional meat purchase specification (IMPS) for fresh veal and calf defines all items of veal and calf available to procuring agencies. However, since these carcasses are small, there is no need to divide them for handling.

Weight ranges. *Weight ranges* for veal and calf are in accordance with the institutional meat purchase specification for fresh veal and calf. As with beef, there are four weight ranges—A, B, C, and D—but each range has a separate weight for veal and calf within that range. Generally, veal and calf are bought using a combination of weight ranges for ease of purchase. The IMPS further gives a complete weight range for cuts of veal and calf derived from specific ranges of carcasses.

Condition Defects. Veal and calf carcasses are more perishable than either beef or lamb, because of their immaturity, high moisture content, and lack of fat covering. Bruises, scores, and contamination are three of the primary defects we observe in calf or veal carcasses.

Bruises. *Bruises* are commonly found on veal and calf carcasses, because of the immaturity of the animals. Sever treatment, such as whiplashing, overcrowding, and trampling by larger animals, penetrates the tender flesh and causes bruises. These animals have a thin covering of hide that also reduces the amount of protection from rough treatment. Bruises may be found on the back, rump, or hip, and must not penetrate into the underlying muscle tissue. Each carcass is examined carefully, and if bruises are noticed, it is advisable to have a plant representative trim the bruised area to determine if it penetrates the underlying tissues. The presence of bruises is not a grading factor; the carcass is either passed or rejected, based on soundness. If a carcass has an extensive bruise which penetrates the underlying muscle tissue, it is rejected as unsound.

Scores. The terms "cuts" and "scores" are considered synonymous. As a guide, "slight cuts and scores" are surface breaks which are not more than 2 inches long and do not penetrate the lean meat more than 1/2 inch from the point of entry. This interpretation applies regardless of where the score or cut is located.

Contamination. Each carcass is closely checked for evidence of rail rust, sawdust, and fecal *contamination.* This check is necessary, since the Government inspector may fail to notice unsanitary conditions that cause this type of contamination in the processing plant.

This is not a complete discussion of all products that are purchased. You, as the inspector, must be aware that requirements change from purchase to purchase. Review the DPSC Technical Data Sheets, Solicitations for Bids, and the corresponding referenced specifications for a complete description of all products purchased. You should study these comments carefully to insure that you know the requirements for the purchase being purchased.

Exercises (609):

1. What are conformation, quality, and finish in veal and calf used to determine?

2. We refer to the lack of fat in veal and calf carcasses as what?

3. Give the three primary defects observed in veal and calf carcasses.

TABLE 1-1

VEAL AND CALF GRADES AND GRADING FACTORS

Grade	Conformation	Finish	Quality
Prime	Broad, compact build tends to be thickly fleshed with a rather plump, well-rounded appearance. Rounds tend to be thick and bulging. Loin and back tend to be full and plump. Shoulders and breast tend to be thick.	A thin covering of firm fat over rump, loin and back extending over the tops of the shoulders and the outsides of the legs. Modest fat streaking on inside of flank muscles, and modest fat covering the diaphragm. Flanks are thick and firm. Kidney and pelvic fat is firm and moderately abundant.	Cut surface of lean is moderately firm, finely textured, greyish pink for veal or greyish red for calf. Texture is velvety to sight and touch.
Choice	Moderately blocky and compact, and broad in proportion to length. All parts are moderately thick fleshed; rounds are slightly bulged and thick.	A very thin covering for veal and a moderately thin covering for calf over back, loin, tops of shoulders and over the outsides of the legs. Moderate fat covering over the skirts and moderate fat streaking in the inside of flank musculature. Flanks are firm, full, and thick. Kidney and pelvic fat is firm and moderately abundant.	Moderately firm, finely textured, and light greyish red in calves, light greyish pink in veal carcasses.
Good	Slightly broad, compact and blocky. Slightly thin fleshed with little or no evidence of plumpness. Loin, back, and rounds are slightly thin and nearly flat.	Extremely thin fat covering over back and loin, with practically no fat over tops of shoulders or outsides of legs. Only traces of fat streaking the flank and covering diaphragm. Small amount of kidney and pelvic fat.	Texture of lean is fine, but slightly soft and dark in color. Cut surface is rather moist to sight and touch.
Standard	Thinly fleshed, rangy, angular, and narrow in relation to its length. Rounds are thin, tapering, and slightly concave. Loin and back depressed. Shoulders and breast are thin.	External fat usually limited to very thin patches over the loin, back, and base of tail. Practically no fat streaking the inside flank muscles and over the diaphragm. Flanks are thin and soft. Only slight amounts of pelvic and kidney fat.	The cut surface of the lean is finely textured, but moderately soft, moist, and slightly dark. Greyish pink in color.

4. State what any surface break in a veal or calf carcass that does not exceed 2 inches in length nor ½ inch in depth in the lean is called?

610. Explain the terms and factors associated with the grading of lamb.

Grades and Grading Factors Related to Lamb. Lamb grading is similar to beef grading. The desired conformation is a blocky, compact, and thickly fleshed carcass. Quality is based on the relationship of maturity to color, textures, and marbling of lean meat. External finish is less important in grading lamb than in grading beef. The USDA quality grades based on these factors are Prime, Choice, Good, Utility, and Cull and the military grades are A through D.

Conformation. Ideal conformation is an animal with good muscling in the shoulders, ribs, loin, and rump. The animal will exhibit a high ratio of lean to bone with a high percentage of the total weight being comprised of the more expensive cuts. The spread of the shoulders is an indication of quality. Rather than being barrel-shaped through the abdominal region, the carcass should be smooth and taper into a plump leg.

Quality. The overall excellence of a lamb carcass is evidenced through the firmness of the lean and presence of marbling. The firmness of flesh can be determined in the flank muscle. Although finish is not a grading factor, higher quality grades of lamb will exhibit marbling, feathering, and streaks of fat in the flank muscle. *Tigering,* defined as strips of lean between the pelt and external finish, is also evidence of high quality carcasses.

Item. Except for the purchase of boneless lamb, this product is purchased in accordance with the items from the institutional meat purchase specifications for lamb. You should review these specifications for the current item and its requirements.

Refrigeration. Ovine meat may be procured either chilled or frozen. The refrigeration requirements for lamb are the same as for veal and other perishable meat items.

Inspection of Lamb Carcasses. The carcass must always be inspected for the presence of a *break joint.* If a shank has been removed in such manner that the break joint cannot be seen, the carcass is assumed to have had a *spool joint.* Weight ranges and styles must be observed to determine conformance with a contact. The evidence of contamination by fecal material or slime will be cause for rejection. The *fell membrane,* a parchmentlike cover on the lean surface, may exhibit water blisters. These water blisters are the result of high-pressure water hoses and may add to slime conditions.

Exercises (610):

1. What are the USDA grades for lamb carcass?

2. Describe briefly ideal conformation for a lamb carcass.

3. What would be considered evidence of a high-quality lamb carcass?

4. How are lamb items purchased?

5. Briefly describe inspection of a lamb carcass.

611. Identify terms and procedures concerning processing, classes, grades, and items of pork and state the inspection requirements for pork and pork products.

Processing Pork. the processing of pork is much the same as that of beef with the exception of scalding and skinning. After stunning and bleeding, pork carcasses are immersed in vats of scalding water at temperatures of 136° to 140° F (55° to 60° C) for 4 to 4½ minutes, in order to loosen the hair. Dehairing is done by machine or depilatory methods. Evisceration and washing are similar to procedures used in beef, but shrouding is not required before chilling, since the skin is not removed during processing.

Specification Terminology for Pork. The meat packing industry divides pork carcasses into two basic styles — *packer* and *shipper.* The packer-style carcass is split down the vertebrae. The head, pluck (liver, heart, lungs), kidneys, ham facings, lean fat, and mediastinal tissue are removed. Nearly all the lumbar, pelvic, and heart fat is also removed. Shipper style is the alternative method of dressing a carcass, but the military does not procure shipper-style carcasses, which are unsplit, with the head remaining attached.

Grade Characterists for Pork. Federal carcass grades for pork carcasses are determined by the relationship between the carcass length and weight, and the amount of muscling and compensation.

Muscling. The degree of muscling for each grade decreases progressively from US No. 1. The degrees of muscling applied to the carcasses are: US No. 1—thick; US No.2—moderately thick; US No. 3—slightly thin; and US No. 4—thin. These definitions of muscling are subjective, and USDA graders learn them through training and experience. There are pictures that attempt to show the muscling, but there is substitute for experience.

Compensation. In each grade, a superior development of muscling is permitted to compensate for a greater average backfat thickness at the rate of 1/10 inch greater backfat thickness for a full degree of superior muscling. Except for the US No. 1 grade, the reverse type of compensation is also permitted at the same rate. In the US

No. 1 grade, this compensation is limited to one full degree of inferior muscling.

Pork Grades. The USDA grades are US No. 1 through No. 4 and Utility. The military procures the best available selection.

US No. 1. Slaughter hogs which have a minimum degree of finish yield high-quality pork cuts. These carcasses have a relatively high ratio of lean to fat and yield more than 50 percent of their weight in the major lean cuts such as hams, loins, picnics, and Boston butts.

US No. 2. These are hogs which are slightly fatter than necessary to produce high-quality pork; the cuts require considerable trimming. These carcasses normally yield from 47 to 50 percent of the major lean cuts.

US No. 3. Included in this grade are overfat hogs which yield a low proportion of lean cuts and a high proportion of fat. The yields of the lean cuts are usually less than 47 percent.

US No. 4. Carcasses in this grade have an acceptable quality of lean but a lower yield of lean cuts in comparison with carcasses in US No. 3.

Utility. These are all carcasses which exhibit lesser developments of lean quality than the minimum described for the first four.

Pork items. After hog carcasses are thoroughly chilled they are delivered to the cutting room where they are broken up or divided into the individual items. Proper chilling is important to facilitate handling the carcasses. Pork carcasses are usually chilled for 24 hours after hogs are slaughtered; then they are cut. Accurate cuts depend on thorough chilling. cuts formed from hot carcasses may become distorted from shrinkage. the temperature of the cutting room is usually around 40° to 50°F (4° to 10°C). In cutting a pork carcass, each side is divided into the anterior, middle, and posterior portions.

Pork refrigeration. Fresh pork is either chilled or frozen as specified by the purchase instrument. If this is not specified, fresh pork is kept in a chilled state. The refrigeration requirements for pork are the same as for other perishable meat products.

Inspection of Fresh Pork. Fresh pork is very susceptible to decomposition and spoilage because of the action of microorganisms and the oxidation of tissues. Because of its susceptibility to spoilage, it is especially important to check fresh pork for bruises, rancidity, and other defects.

Bruises. Bruises are areas of flesh infiltrated with blood, and they are caused by injuries. Those bruises which involve only the skin are considered minor, but those involving fat and lean are major defects. Cuts showing bruises in fat and lean tissue cannot be accepted by the military.

Rancidity. The major cause of rejection of pork products is oxidative or hydrolytic *rancidity*. There is an unstable fat constituent in pork which combines with oxygen to cause oxidative rancidity. To prevent this, fresh pork should be wrapped or not stored any longer than necessary. Cured pork products have antioxidants added to prevent oxygen from combining with the fat constituent. If pork is stored at temperatures above 40° F (4° C), an enzyme called *lipase* is produced by bacteria and will combine with moisture to produce hydrolytic rancidity. The best preventative for hydrolytic rancidity is storage temperatures of less than 40° F (4° C).

Hair roots. Presence of these indicates poor workmanship during the dehairing process. In most wholesale cuts, the skinning required will prevent this defect, but some cuts, such as bacon bellies, frequently exhibit ***hair roots.***

Seeds. These are the mammary tissue of pork bellies. White *seeds* indicate the carcass is from a gilt, and the mammary gland has never been active. When the seeds appear red, it is an indication that they were active on a sow. When the seeds are black, the indication is that this is a belly from an old sow.

Odors. Pork products that emit any type of foreign odor are unsatisfactory. Cut derived from old stags and boars have a distinct odor associated with sex glands.

Color. Fresh pork is bright gray-pink and uniform in *color*. Old hogs yield a carcass with a dark color. A carcass with dark color or deposits of pigment on its skin surface is cause for rejection on procurement inspections.

Inspection of Bacon and Ham. *Bacon* usually means the cured and smoked bellies of hogs; however, in some countries the term refers to any cured and smoked pork product. A *ham* is the thigh of an animal prepared for food. There are regular hams which have a covering of skin and fat over the entire back, and there are skinned hams which have skin removed from the back down to within 4 inches of shank.

Bacon. The quality of green, fresh bellies is indicated by the color and the texture of the skin, the fat, and the lean. A high-quality belly should be smooth and flexible and free of bruises, cuts, wrinkles, coarseness, and discoloration. The fat portion should be white and firm. The lean should have a red color and should be of fine texture. The good features are influenced by good feeding and breeding. Hogs fed on grain yield a firm white fat. Meats with a firm white fat chill readily and are easily trimmed into cuts which retain their shape. Hogs fed oily feeds such as soybeans, peanuts, and acorns will produce a brown fat that is soft and oily in texture and that is not acceptable for military use.

Defects in bacon. A common defect seen in bacon is bruising. Injury to a live animal while it is being transported or handled before slaughter may cause this defect. During the bleeding phase of the slaughter operation, the blood of bruises is entrapped in the tissues. Sometimes bruises are not visible in the green uncured belly, but they become very apparent after curing and smoking. Bruises are a defect because they detract from a product's appearance and because the affected area is subject to spoilage. Other defects are scribe cuts, presence of black seeds, presence of bone, hair roots, unsmoked areas, and mutilation in handling.

Inspection procedures. When inspecting bacon, use the trier from the food inspection kit. Three landmarks for making the trier inspection are the flank pocket, the featherbone line, and the brisket end. Off-odors, rancidity, and slime should be checked when performing a trier inspection. As in inspecting other meat products, you should check purchase orders and all related supporting documents to make sure that the meat conforms to all terms of the contract. Slab bacon is usually bought in 2 weight ranges: an 8 to 12 pound range and a 12 to 14 pound range. The amount of fatback removed should not exceed 1¼ inches from the scribe for a low average. A bacon slab should be at least three-quarters of an inch thick at any point except the edges. The leaf fat and excessive cartilage should be removed. Also the slab should not have unsmoked areas, hair roots, mutilations, or black seeds.

Specification for bacon. The current specification (PP-B-81) distinguishes two primary types of bacon. Of these two types, only type II (special) is procured for military use. Type I (standard), which is not purchased by the military, is basically a commercial product. Included under type II bacon are several forms, styles, and classes.

a. Type II (special)—form A refers to slab bacon, and form B refers to sliced bacon. Type II will appear in one of the following three styles: style 1, one full slab, shingled or reformed, wrapped in wax paper; style 2, 1 pound units not vacuum packed; style 3, 1 pound units partially vacuum packed. The three classes of type II bacon are: class I, chilled; class 2, frozen/overseas; and class 3, frozen/domestic. Inspectors should be alert to new changes and amendments to the specification.

b. Requirements for type II—uncured bellies for class 1 (chilled) and class 3 (frozen/domestic) may be frozen provided they have been stored at 0° F(−18° C) or below for less than 60 days. Total time in the smokehouse is 12 hours or more. Smokehouse temperatures may vary but will exceed 120°F (49° C) during the entire period. Class 1 products are placed and held at 40° F (4° C) or lower. Classes 2 and 3 are placed in a freezer at 0°F (−18°C) or lower within 120 hours after completion of smoking.

Hams. The ham quality determination factors of skin, fat, and lean are much the same as the factors in bacon. However, for hams, bone becomes a very important factor. The bone must not be excessively large nor excessively hard and white. Cut surfaces of the aitchbone of a young animal are cartilaginous or red, while the cut surfaces of this bone of an older animal are white and flinty. The meat from the ham of an old animal is likely to be tough. The skin should be smooth, soft, firm, and unwrinkled. The lean should be firm and have a good color. The fat should be white and not excessive. The smoked product should be brown and smooth.

Inspecting the shank. A primary off-condition to check for in hams is *souring*. The most common area for souring is in the shank end of the ham where the bones of the thigh, knee, and two lower leg bones are located. These bones are surrounded by tendons and fibrous material. It is difficult to penetrate these areas adequately with curing agents. When these areas are not adequately cured, bacterial growth may be stimulated during the smoking period and souring may result. A trier can detect this condition.

Examining the butt end. The fat on the aitchbone, row of the femur (under the aitchbone, along the femur), and the stifle joint should be checked with a *trier*. Pelvic fat is very unstable, and if any remains on the aitchbone, souring is possible.

Using the trier. The trier is an instrument that resembles an ice pick used to probe areas for sourness. It should be clean and free of any odors that might interfere with the examination. It is inserted into the areas mentioned above, then withdrawn and held under the nose to detect the odor of sourness.

Boneless Pork, Frozen. Boneless pork, frozen, for military procurement purposes, consists of the pork loin further processed into roasts and slices. Type I is the identification for roasts, and type II, for slices. The pork loin is the only market cut that is prepared as boneless pork.

The fresh, chilled, bone-in pork loins must be in excellent condition at the time of boning. They must show no evidence of such conditions as off-odor, slight stickiness, rancidity, sourness, or discoloration. The loins, before boning, must be full-cut, and trimming the lean from the loins to meet the weight range is not permitted. The internal temperature of the bone-in loins, at the thickets part, must be between 28° and 40°F (-2° to 4° C) from the time of initial chilling until they are boned. The maximum internal temperatures at the thickest part of the chilled pork loins, after boning and until the fabricated product is placed in the freezer, cannot exceed 42°F (6° C).

The color of the bones ranges from red to dark pink, with the color of the exterior surface of the rib bones showing at least a slight red color. Cartilage must be in evidence. The split chinebones, spinous processes, and crosscut sections of bones should be porous and not brittle or flinty.

The exterior fat of the loin must be firm and white. The lean should be fine-textured and firm, with at least a slight amount of marbling in the blade and ham ends. The lean meat possesses a bright, uniform color, ranging from light pink or greyish pink to bright red, and the flesh must not be dark, gummy, or oily. Finally the pork loins must be thick, uniformly full, and well-rounded. They should show no evidence of thawing, refreezing, or freezer burn.

The following carcass portions must be removed and excluded from loins used for both type I and type II fabricated pork:

- Flank meat, tenderloin, and blade meat (meat lying over the blade bone).
- Bone, cartilage, blood clots, bruises, semiattached fat, or tag ends.
- Surface fat in excess of ¼ inch in thickness.

Temperature Requirements. At the time of delivery, frozen items must show no signs of thawing and refreezing and must have an internal temperature of not higher than 10° F(−12° C) if for export use and 15° F (−9° C) if for domestic use. Chilled items must have a temperature of not more than 45°F (7° C) at the time of delivery. Products which exceed these temperatures should be rejected. In those cases where the product exceeds the required temperature but the delivery temperature is not more than 5° F higher than that required, the contracting officer may authorize the vendor to rework the product. In order for the contracting officer to authorize this rework, the vendor must immediately reduce the temperature and reoffer the product. The temperature at the time of the reoffer must be no higher than 5° F (−15° C) for frozen products for export, 10° F (−12° C) for frozen products for domestic use, and 40° F (4° C) for chilled products.

Column A

____(1) Not required since the skin is not removed before chilling.
____(2) Pork items remaining after the removal of the shoulder, ham, belly, and back.
____(3) Maximum fat thickness allowed on a selection No. 1 ham which weighs 15 pounds.
____(4) Minimum thickness of a bacon slab at any edge.
____(5) The USDA grade of pork that exhibits moderately thick muscling.
____(6) The USDA grade of pork that exhibits minimum degree of finish and yields high-quality cuts.
____(7) Overfat hogs that yield low proportion of lean cuts and high proportion of fats.
____(8) A ham that has its skin left on.
____(9) A ham that is partially skinned.
____(10) The entire intact rib section after removal from the belly.
____(11) The name for bacon before it has been cured and smoked.
____(12) The sightly wedge-shaped portion of the pork shoulder after separation from the standard picnic.
____(13) The mammary tissue of pork bellies.

Column B

a. Backfat.
b. Type II (special).
c. Belly.
d. Seeds.
e. Type I (special).
f. Shipper style.
g. Loin.
h. Stifle joint.
i. US No. 2.
j. Spareribs.
k. Fatback.
l. Star joint.
m. Shrouding.
n. Regular loin.
o. Clear plate.
p. US No. 1.
q. Skinned ham.
r. Short-shanked ham.
s. Boston butt.
t. US No. 3.
u. Ham.
v. 1½ inches.
w. Short-shanked shoulder.
x. ¾ inch.

Exercises (611):

1. Match each term in column B with its related descriptive statement in column A. Some responses in column B may not be used:

2. State major cause of rejection of pork.

3. At least how thick should a bacon slab be at any point except the edges?

4. Indicate a primary off-condition which you should check for in hams.

5. The maximum internal temperature of chilled pork loins after boning and until fabrication must not exceed how many degrees (Fahrenheit and Centigrade)?

6. Each box of pork, boneless, frozen, type II can contain not more than what percent facing slices by weight?

7. Once fabricated pork is frozen, it must stay at a uniform temperature not to exceed how many degrees (Fahrenheit and Centigrade)?

612. Supply the grade determinants used in quality grade evaluations of poultry.

Quality Grade Determinants for Poultry. In determining the quality of poultry, as in other species of meat animals, we are concerned with the palatability and/or edibility of the product. USDA has the responsibility of determining the quality of poultry and poultry products. This Department has, in turn, developed a set of determinants used in quality grade evaluation. These factors are found in the USDA publication: *Regulations Governing the Grading and Inspection of Poultry and Edible Products Thereof and U.S. Classes, Standards* *and Grades With Respect Thereto.* In charts summarizing the grade requirements you will see that A, B, and C grades (or quality) are shown. Information from these charts is used to develop the basic grade determinants.

Conformation. This grade determinant refers to the general outline or shape of the bird, and is based primarily on the skeletal structure.

Fleshing. Fleshing refers to the amount and distribution of flesh on the bird, particularly on the drumstick, thighs, and breast. When determining this factor, keep in mind the age and species of the bird, because the degree of fleshing will vary accordingly.

Fat covering. This refers to masking of the color of flesh beneath; inexperienced graders are quite likely to be too strict in applying this factor when grading young birds that have not yet added a good covering of fat.

Pinfeathers. *Pinfeathers,* considered when grading poultry, can be placed into two types; protruding and nonprotruding. Protruding pinfeathers are those which have penetrated through the skin, but have not necessarily formed a "brush." You will be able to insert your fingernail under the protruding ends of such pinfeathers. Nonprotruding pinfeathers are those that can be seen but which have not pushed their way through the outer layer of skin. When grading dressed poultry, you must consider both the number and location of these types of pinfeathers. A bird is considered free of protruding pinfeathers if it has a generally clean appearance (especially on the breast); and if no more than an occasional protruding pinfeather is in evidence during careful examination.

Vestigial feathers. These are rudimentary structures. There are two types of *vestigial* (imperfectly developed) *feathers:* hair and down. Hair is easily removed by singeing. Small silky feathers with no web lying between the main feather lines are known as *down.* It is very common on ducks and geese, and is often seen on fryers. Down is difficult to remove, and when wet, it clings to the skin and cannot be easily seen. All grade A poultry must be free of vestigial feathers and protruding and nonprotruding pinfeathers.

Cuts, tears and missing skin. Cuts, tears, and missing skin detract from the appearance of the bird; permit the flesh to dry out when the bird is cooked (Thus lowering the eating quality of the bird); and expose the flesh to dehydration in storage. If the defect is on the brest or legs, less tolerance is permitted, because these are the highest priced parts.

Discoloration. Discoloration factors basically involve the color and the type and size of *discoloration.* Certain varieties of chickens and turkeys have a normal bluish-green color as well as a brownish-black pigment, melanin, in the feather follicles on the abdominal area. Even such natural discoloration should be considered as part of the aggregate area of discoloration.

Bruises. Bruises of the skin may be distinguished from flesh bruises by moving the skin. Bruises must be removed before grading, and the resulting cut is considered along with other cuts and tears. All discoloration defects must be considered in the aggregate to determine the total area involved. Discoloration on the breasts and legs is less acceptable than that on other parts of the body.

Broken or disjointed bones and missing parts. The number of these defects allowed varies with the grade. There must be no related bruise or blood clot. There are some parts of the bird which may be removed without affecting the grade. These include the pygostyle (free part of the tail) and the tips of the wings. Carcasses which are to be used for cut-up styles may have had any number of parts removed for any reason. Cartilage which is separated from the breastbone is not considered to be a "disjointed or broken bone."

Freezer burn. Freezer burn is a discoloration of surface tissues resulting from dehydration while in frozen storage. The effect on grade depends on the extent of the dehydrated surface area measured in square inches.

In determining the quality of a particular bird, the carcass must be judged on the basis of each of these factors. The overall quality assigned to it can then by no higher than the lowest of the individual quality factors. The grading factors for turkeys are practically the same as for chickens. A greater amount of defects is permitted for turkeys because of their larger size.

Exercises (612):

Write the grade determinant term in the space following its definition.

1. The determinant referring to general outline or shape of the bird.

2. Discoloration of surface tissue due to dehydration while in frozen storage.

3. Imperfectly developed feathers (hair and down), which grade A poultry must be free of.

4. These must not be related to bruises or blood clots; some of these may be removed without affecting the grade.

1-4. Use of Food Additives.

In addition to the use of salt and sugar, there are many other additives used in preserving foods, adding color or flavor to foods, or in the actual processing of foods for particular cultural requirements. Preservatives, or additives, have been used in food for centuries. You need to be aware of what is allowed and prohibited in the use of food additives so that you can protect the health of the consumer more effectively.

613. Indicate acceptable usages and practices concerning food additives.

Food Additives. Today, through advances in chemistry and food technology, many chemical compounds are added to foods to stop the growth of microorganisms without injuring the foods. The use of chemical preservatives in food is closely controlled by the Food and Drug Administration, which has enforcement responsibility for the Federal Food, Drug, and Cosmetic Act, the act that regulates foods that enter interstate commerce. Some of the established criteria pertaining to the use of chemical food additives are that they must:

a. Not injure the consumer.
b. Improve the food material.
c. Not reduce action of digestive enzymes.
d. Not react to form harmful compounds in the body.
e. Be easily identified.
f. Be proved safe before use.

Among the additives used in foods are sugar, acids, salt, sulfur compounds, oxidizing agents, antioxidants, enzymes, and food flavor amplifiers. We will examine these allowed additives and then briefly consider a few forbidden additives.

Acids. Acids are used to improve the flavor of foods and to help in food preservation. Among the acids used in foods are the benzoates, the propionates, citric acid or citrus juices, acetic acid, and phosphoric acid. Acids are added to foods to attain a pH that is unacceptable to those organisms that are present. While to some persons they enhance food flavor, to others they harm the taste. From a practical standport, this information may be useful to you. When potato salad is acidified to a 4.5 pH level, it is much safer to serve than is the normal, rather bland potato salad or sweet potato salad concoction. This is also the reason that various fruit and lemon-custard-type pies need not be refrigerated. They, too, have a low pH.

Benzoic acid or its salt, sodium benzoate, in a concentration of 0.1 percent, is fairly effective in preventing the growth of bacteria, yeasts, and molds. It is added to soft drinks and acid foods as a preservative. The use of ethyl vanillate in World War II made it possible to deliver acceptable foods to many parts of the globe.

The salts of propionic acid (a fatty acid) are nontoxic; they are used to inhibit mold in bread and cakes. Propionates are also used to inhibit the growth of surface mold in cheese. Soft cheeses, such as cottage cheese and cream cheese, may be protected from mold by the addition of calcium propionate.

Sulfur compounds. *Sulfur dioxide* and various *sulfites* are used in the preservation of acid fruits and vegetables. They are effective against molds but are not very effective against yeasts. The sulfur substances can reduce food palatability and may inactivate some vitamins. Fruits are sulfured by burning sulfur or by exposing fruit to sulfur dioxide gas. Apples may be dipped in a solution of sodium bisulfite or sulfur dioxide.

Oxidizing agents. *Oxidizing agents* are used in meat, fish, flour, fruit, and vegetable preservation. Bleaching agents are used to preserve flour. Other oxidizing agents include hypochlorite solutions to inhibit mold growth on fruits.

Antioxidants. *Antioxidants* are substances that are added to foods to protect them chemically against oxidation. A common form of oxidation is one type of rancidity of fats. This oxidation (oxidative rancidity) may develop and be accelerated by light, air, moisture, heat, and catalysts, such as copper. Among the antioxidants used are the tocopherols, ascorbic acid, and citric acid. The tocopherols (including vitamin E), come from vegetable oils and are good antioxidants for animal fats. Ascorbic acid is used to prevent the rancidity of mayonnaise and to prevent the browning of the unprocessed cut surfaces of such fruit as peaches, apples, and apricots. Two percent citric acid or 0.1 percent hydrocloric acid are also used to prevent sliced peaches from browning.

Enzymes. These substances are used to break down connective tissues and tenderize meat. Tenderizing *enzymes* include papain, bromelin, and ficin, each of which is heat-liabile.

Flavor amplifiers. Included in the *flavor amplifiers* are monosodium glutamate and many spices. With a few exceptions, these flavor amplifiers are not food preservatives. Some spices, such as cloves and cinnamon, are bacteriostatic to some degree, and some are even bactericidal in certain situations.

Artificial sweeteners and miscelaneous. *Artificial sweetenrs* have been widely used in dietary foods as well as in many other foods consumed with no dietary intent. Artificial sweetners have no food preservation quality as sugar might have. Consequently, foods that might have been preserved had they contained a high sugar content are not preserved solely by the addition of artificial sweetners. Thousands of other food additives are approved for use under the guidance of the Food and Drug Administration. All have specific criteria for use, and some are toxic if applied beyond the limits intended for their use. Others have special disadvantages in their use. Questions concerning additive usage should be referred to the closest Food and Drug Administration representative.

Forbidden food additives. Among the forbidden food additives is sodium sulfite, a toxic substance sometimes used illegally to redden stale meat. Also included are sodium nicotinate, salicylic acid, hydrogen peroxide, quarternary ammonia compounds, and antibiotics.

Exercises (613):

Identify each true statement and explain why the others are false.

T F 1. Food additives should reduce the action of digestive enzymes.

T F 2. Acids cannot be used as food additives.

T F 3. Sodium benzoate is added to soft drinks to prevent the growth of yeasts and molds.

T F 4. Oxidizing agents are added to foods to prevent oxidative rancidity.

T F 5. Enzymes are used to break down the connective tissues of meat.

T F 6. Most flavor amplifiers including monosodium glutamate are very good food preservatives.

T F 7. When food additive usage is questionable, the Food and Drug Administration should be contacted.

614. Identify curing agents/additives and methods/techniques with their purposes and pair applicable terms and phrases with defects found in cured and smoked meats.

Curing Methods. Meat products must be held under refrigeration, preferably below 40° F (4° C). This is to insure that enzymatic action, bacterial growth, and oxidation are inhibited. Another consideration is sanitation. Good sanitary practices reduce bacterial contamination and bacterial growth. The two principal methods of curing fresh meats are with dry salt and with pickle solution.

Dry salt curing method. This method involves applying salt without other agents to the surface of the meat. After the cuts are rubbed or sprinkled with salt, they are placed on racks, and additional cuts are stacked on these with a layer of salt between the cuts. After several layers have been stacked, the salt is spread over the exposed areas of the stack, and it is left to cure at a temperature below 40° F (4° C), in subdued light. Curing takes several weeks. During this period, "overhauling" is necessary. This is a restacking of the cuts, so that those which were on top are placed on the bottom of the new stack and those which were on the bottom are placed on the top. Overhauling equalizes pressures on the cuts to allow a more equal rate of salt absorption and reduces the possibility of rancidity by placing the cuts which were initially exposed to the air on the inside of the stack. During the curing, moisture is extracted from the tissues, and the salt is dissolved in the tissue fluids. It is frequently necessary to add dry salt, because solution concentration is lowered by extracting the tissue fluids. Dry curing is confined largely to fancy bacon bellies, boneless butts, Canadian bacon, briskets, sausage meats, and similar items. A definite quantity of bellies and a proportionate quantity of cure are weighed out for each box; the box is then loaded. Each belly is lightly covered with cure and placed in the box, skin-down, in close contact with the others. This is continued until the box is nearly full, then the last layer is put on, usually skin up. To distribute the cure evenly, some packers weigh into individual containers the amount of the cure that is to be used on each layer of bellies. Oiled paper is put over the top layer, and the box is closed.

Pickle curing method. The term "pickle" as applied to meat curing means a solution of the curing agents. Plain pickle is simply a solution of salt in water. Compound pickle contains salt, sugar, and/or sodium nitrate and/or sodium nitrite. Pickle that contains sugar in some form is also known as "sweet pickle":

Formulation. Pure water at 60° F (16° C) weighs 8.34 pounds per gallon at sea level and will dissolve 3.03 pounds of salt. This solution, however, will make more than a gallon of pickle. For general purposes, a saturated solution of salt in water is considered to contain 2.5 pounds of salt per gallon or 25 percent by weight. The degree of saturation, or the intensity of pickle, is determined quickly by an instrument called a *salometer.* This instrument has a calibrated stem marked 0 at the point to which the salometer sinks in pure water and 100 at the point registered in a saturated sale solution; the intervening space is graduated in degrees. Salometers are gauged between 0° to 40° (degrees salinity), 40° to 70°, and 70° to 100°. They are made to read accurately at temperatures between 35° and 38° F (2° and 3° C). The degree of saturation or the strength of any pickle can be determined quickly with one of these instruments.

Plain picke. Pure water and salt —usually crushed rock salt) are used here. The salt is placed in large vats, and water is run through it, either by being forced in at the bottom and overflowing at the top, or by gravitating through from the top and being drawn off at the bottom. The water passing through the salt becomes saturated and is drawn off at 100° strength (salometer value). Any gross impurities in the salt are removed by straining the brine through fine copper screening, then through cloths, and finally, filtering it through sponges. The 100° pickle is then drawn off into large holding vats, where it is standardized to any desired strength by addition of water. The pickle may or may not be sterilized, depending upon the purity of the materials used.

Compound pickle. In making compound pickle, the brine is reduced to the desired salt strength by adding water. A sterile solution of the other curing agents is added to this. The sugar, sodium nitrate, and sodium nitrite are dissolved in a vat in as little water as is necessary to put them in complete solution. Solution is-hastened by boiling, which also sterilizes the solution. The solution is then added to the brine to produce pickle of the required strength and curing ingredients.

Applications. The strength of pickle varies greatly with the purpose for which it is to be used. For curing purposes, pickle is designated as *curing* or *cover pickle,* and *pumping pickle.* Pumping pickle is invariably stronger than cover pickle, since pumping is done to introduce the curing agents into the meat rapidly without introducing excessive amounts of water. Some establishments use pumping pickle of 100° salt strength plus other curing agents. Most packers, however, use pumping pickle of about 90° strength. Cover pickle varies in different establishments and in the same establishment with the kinds and grades of meat cured. Fancy hams, for example, are usually cured in pickle of 75° to 80° strength. In general, the milder the pickle, the milder the cure. Most packers make two or more grades of hams; the highest or "fancy" grade is given the mildest cure. Nearly all curing pickle is "compound pickle."

Specialized Procedures in the Curing Process. Understanding principles involving basic methods of curing require more specific knowledge of the subject than we can present here. However, let us look at a few specialized procedures to more adequately visualize potential problems which may be identified on our inspection.

Pumping. *Pumping* is a term which describes a means of injecting a curing solution into the interior of meat. This is done by forcing the pickle (curing agent) into the meat through a needle under pressure. The two methods of pumping are the stitch or spray and the artery methods.

Stitch method. In *stitch pumping,* the needles are inserted into the pieces of meat in many areas, and several strokes per area may be injected. The amount of pickle introduced varies from 5 to 14 percent of the weight of the cut. Usually the quantity does not exceed 10 percent. Injection pumping, a variation of stitch pumping, is a mechanical means of injecting a predetermined amount of pickle into cuts passing on an assembly line.

Artery pumping. Artery pumping is generally used for hams. The ham is placed on scales with a graduated dial. The needle is inserted into the large artery near the aitchbone, and pressure distributes pickle through the ham. An 8 percent increase in the weight of the ham is necessary to insure adequate permeation of the pickle solution. Hams can be pumped to an increase in weight of 20 percent, but in those cases, a light pickle concentration is used.

Overhauling. As explained earlier, *overhauling* is done to insure that all pork cuts are adequately cured. During the first week, much of the salt has dissolved in the meat juices and may be too diluted, or it may have drained away. To insure adequate curing, dry salt-cured meats are rearranged and resalted on about the seventh day. Small cuts are overhauled only once, while large cuts with bones in them are usually overhauled on the 7th day, in 18 to 20 days, again in 35 to 40 days, and every 40 days until the cuts are shipped. Sweet pickle meats are overhauled earlier than are dry salt meats. Bellies and small meats are overhauled at 3, 10, and 18 days. Long-cure hams and shoulders are overhauled at 5, 15, and 30-day intervals, and then every 30 days. Artery-pumped hams may be overhauled once or not at all. The same pickle is used; it is not strengthened:

Barreled meat. Meat packed in barrels is overhauled by rolling the barrel to stir the pickle and to loosen any close contact pieces of meat.

Dry cure. Dry-cured meat is not overhauled because the pieces are small and the first cure is adequate.

Second pickle. Pickle that has been used to cure meats is called *second pickle.* During the curing process, the meat takes up from the pickle considerable quantities of the curing agents. Fancy ham pickle, for example, may be reduced from 70° strength as fresh pickle to 50° strength as second pickle. However, the remaining curing agents (particularly in compound pickle) are still usable and too valuable to throw away. Likewise, the second pickle contains end products of nitrate conversion and bacteria desirable for further curing operations. But second pickle also contains many soluble protein substances and inorganic meat substances, which are vulnerable to decomposition. These must be removed before the pickle can be used for further curing. Second pickle is prepared for reuse by bringing it to a temperature of 200° F (93° C), skimming off the scum produced by the coagulating albuminous substances, filtering, and bringing the remaining pickle to the desired strength by adding the proper quantities of salt and other curing agents. As a rule, only compound pickle from fancy grades of meat is reused. Second pickle from fancy grades of meat is reused. Second picle contains about two-thirds of the original salt and sugar and one-half of the nitrate used in the original pickle.

Backpacking. This is a procedures of repacking meats which are nearly cured into tierces with a 25° pickle at a temperature of 0° to 15° F (−18° to −9° C). While this does not completely arrest the cure, it does retard it. This procedure is used to store cured meats awaiting consumer demand. Pickle-cured meats may be withdrawn at the end of the cure and stored in racks under refrigeration. At 36° F (2° C) such cuts may be held for 2 weeks. At lower temperatures, the meats may be held longer, but they should not be stored for longer than 50 days.

Curing Other Meats. We have already discussed the curing process in the production of bacon and ham. Certain cuts of beef are cured in the same way pork is cured. Since the processes are so similar, we will discuss curing these beef cuts now. They are corned beef, beef hams, and beef tongues.

Corned beef. Corned beef may be prepared from any part of a carcass; usually the brisket and rump pieces are used. In preparing corned beef, the cut is rubbed with salt, and the cuts are packed in layers. A 20 percent brine solution with sugar, nitrates, and nitrites is poured over the cuts. The beef is then stored for 25 days at about 36° F (2° C). During this period, it may be overhauled two or three times.

Beef hams. This is a term applied to cured rounds or parts of rounds. The rounds may be cured in a pickle containing salt, cane sugar, and nitrate, or they may be pumped by introducing pickle into their arteries. When the hams are cured by putting them in vats with the pickle, 100 days may be required to complete the cure. The cure may be shortened to 20 days with artery pumping. The beef hams are used for dried beef.

Beef tongues. The tongues may be cured by pickle or artery pumping. The cure takes 55 days in a pickle tank;

it can be completed in 5 days if artery pumping is used.

Gains and Losses. As with long-term handling of any product, losses in weight and defects occur in cured products. If the pickle introduced into the product or absorbed by the meat is more than the shrinkage resulting from the curing process, a gain in weight results.

Dry salt cure. Loss of tissue fluids causes a loss of weight in this cure. Dry-cured meat shrinks very little, because none of the extracted moisture is drained and because absence of air prevents evaporation. However, lean meat has the greatest loss, because of its high moisture content. Large fat pieces of meat lose less moisture, because less moisture is extracted from the deep tissues.

Pickle-cured meat. Pickle-cured meat (except pickled tongue) always shows a gain in weight. The amount of this gain varies with the amount pumped, the class of meat, and the length of the curing period.

Loss of nutritive substances. There is a loss of nutritive substances, such as albumin, phosphoric acid, potassium, salts, and meat bases. Cured meats have less nutritive value than does the green cut from which they come.

Defects of Cured Meats. We discussed defects of ham and bacon earlier in this chapter. The defects found in fresh port usually remain in the cured product. This type of problem is due to a defect in original product and not to the cure process. However, two problems specifically involved with the cure do merit further comment.

Insufficient penetration of the pickle. Insufficient penetration of the pickle, either from poor technique in arterial administration or from insufficient volume of injected pickle, results in a lightly colored product susceptible to spoilage.

Ropy pickle. When bacterial action causes pickle to become stringy and sticky and to have a fetid odor when it is warmed that pickle is called *ropy pickle*. These conditions are caused by excessively high temperatures in the curing cellars, unclean vats, nonsterile pickle, contaminated or slimy meats, neglect of overhauling, and other factors. If ropy pickle is discovered early in the curing process, meat may be salvaged by promptly dumping the pickle, thoroughly washing the meat, sterilizing the vats with live steam, and recovering the meat with fresh pickle. Meat allowed to remain in ropy pickle may spoil.

Smoking. The objectives of smoking meat are to remove moisture to retard bacterial growth, to impart a desirable smoked flavor, to stabilize a cured color, to prevent oxidative rancidity, and to kill surface bacteria.

In smokehouses, hickory chips and hickory sawdust are generally used to produce the smoke. The heat is produced by steam coils inside the smokehouse. The temperature range is from 120° F (49° C), necessary for color fixation, to 150° F (65° C), necessary for a "ready to eat" product. This temperature (150° F 65° C) is required to provide the heat required to kill pathogens that may exist in the product, including trichina, which is killed at a temperature of 137° F (58° C) or higher. The older stationary smokehouse has many stories and is constructed of brick. The air and smoke circulate through natural currents; therefore, uneven smoking and heating are common. The rotary-type smokehouse prevents much of this problem by rotating the products constantly during smoking. There are new conditioned types of smokehouses called *Julian smokehouses*. They are totally air- and smoke-controlled to prevent uneven heating and smoking and are capable of washing the product after smoking.

Defects of Smoked Products. Let's look at three of the more common defects of smoked products—drips, touchers, and drys.

Drips. This is a condition of fluid dripping from the product on the higher trees onto products below. Excessive moisture in the cured product causes this condition.

Touchers. This condition is recognized as a light colored bald spot on the ham. This spot is subject to spoilage; it is caused by two hams touching one another, thereby keeping smoke from permeating all the outer surfaces of the meat.

Drys. This is a dry condition of the smoked cut caused by excessive heat in the smoking process.

Exercises (614):

1. Match the curing agents/additives in column B with their purpose is listed in column A.

Column A	*Column B*
____(1) May be used as a preservative.	a. Salt.
____(2) Is a reservoir for nitrites.	b. Sugar.
____(3) Tones down brackishness of salt.	c. Nitrates.
____(4) Sets the color of the product.	d. Nitrites.
____(5) Used as a flavor additive only.	e. Antioxidants.
____(6) Retains the color of the product.	f. Spices.

2. Provide the proper term or phrase answering each following item:
   a. What technique is used to equalize pressure on cuts so as to promote better salt absorption and reduce chances of rancidity?

   b. What kind of pickle contains a higher concentration of curing agents than what other kind of pickle?

   c. What kind of pickle referred to in item (2) is used for rapid permeation of tissue by the agents while keeping water content low?

   d. In order to insure thorough permeation of the pickle, which is evidenced by an 8 to 20 percent weight increase, what method of pumping is used?

e. What is the process of delaying or slowing down curing with 25° pickle for the purpose of holding meat in storage known as?

f. What is the purpose of artery pumping beef?

g. Give the objectives of smoking meat.

3. Supply the proper word or phrase answering each following item:
   a. Cite the method of curing causing a loss of weight in product.

   b. What is the term for a stringy, sticky pickle due to bacterial action that can cause meat spoilage?

   c. What are light-colored bald spots occurring in smoked hams in contact with each other called?

   d. By what term are defects in smoked cuts caused by too much heat known?

1-5. Common Deterioration and Spoilage Factors

We have already discussed some of the defects associated with the inspection of animal-origin food products. In many cases, you will be looking for the same defects at your point of inspection, i.e., the food inspection office at your base. In some specific instances, the food item may take on additional types of defects with which you must become familiar because you are providing a service to protect the health of the consumer *and* the financial interests of the Government, you must be alert and fully knowledgeable about those product defects that may occur after processing.

615. Define specific defects, specify terms/phrases selected to give anatomical areas of deterioration, and requirements for net weight and temperature determinations in carcass beef.

Defects of Carcass Beef. The abnormalities we see in carcass beef can be internal or external defects which are present at slaughter or occur as latent defects. The major quality defects and causes of unwholesomeness are easily detected during verification inspections.

Defects present at slaughter. The longissimus dorsi muscle, which is commonly referred to as the *eye of beef* in carcass beef, is exposed in both hindquarters and forequarters. As the carcass is ribbed to develop quartered beef, the eye of beef is exposed in the hindquarter as *loin eye* and in the forequarter as *ribeye*. This exposed muscle can indicate various abnormal conditions which affect the entire carcass.

Dark cutter beef. The dark color and sticky, gummy texture of this meat is not acceptable. This meat is depleted in glycogen (energy sugar), from which lactic acid is produced in the muscle. Lactic acid is a normal constituent of the muscle and maintains a low pH, or acid, condition. With glycogen depleted, lactic acid is not produced and a high pH, or alkaline, condition exists. Muscle enzymes and bacteria become very active in this elevated pH and use up the oxygen available for combining with the muscle protein, myoglobin. The red color of meat is caused by muscle protein absorbing oxygen. Muscles become dark or black in color when there is a lack of glycogen, lactic acid, and available oxygen, especially during periods of increased activity. The sticky, gummy texture is a result of the alkaline pH breaking down the muscle protein. Such carcasses are normally graded down one full quality grade in the top five grades only, since it is not considered a factor in the lower grades.

Spotters. The most probable cause of spotters is excitement prior to slaughter, which results in improper bleeding. Dark spots of hemorrhage of varying size are evident throughout the muscle tissue of the eye of beef. It is most often seen in top grade cattle not accustomed to exercise. The presence of these small hemorrhages encourages contamination and deterioration of affected tissue. The disposition of such carcasses depends upon the severity and location. Severe cases are rejectable in the processing establishment for military products, while the USDA may only downgrade the carcass for esthetic reasons.

Two-toning. This term refers to carcasses exhibiting two definite shades of red coloring in the eye of beef. The cause for this color difference is unknown and disposition is most often to accept. There is no wholesomeness factor in danger. Only esthetic values are considered when this condition appears.

Sore or scar. This is a small, soft, off-white water spot in the logissimus dorsi muscle. The spot has the appearance of a very unappetizing sore. This sore results when the larvae (grub) of a fly, *hypoderma lineata*, penetrate the hide and the eye of beef. Carcasses may be trimmed or rejected at destination, based on severity.

Callous. Deposits of heavy connective tissue resulting from a healed injury are referred to as "callouses". A puncture-type wound or injury to the beef eye will be healed by tough connective tissue. Rejection on the basis of poor quality is rare, but possible.

Latent defects. The potential danger of these defects from a wholesomeness viewpoint makes them important. Each one is dangerous to varying degrees and severity is the measurement for disposition. Time in storage is very important in most cases because these defects are often not dangerous until some deterioration occurs:

Sour round. This is a specific foul smelling fermentation and putrefactive process occurring in the ball-socket joint of the hindquarter of heavier beef carcasses. It is caused by slow cooling or a combination of poor chilling and poor ventilation. A meat trier is used to detect the problem by smelling the trier before and after inserting it into the ball-and-socket joint. Carcasses possessing sour rounds should be rejected and returned to the contractor. If detected after final acceptance, the procurement agency concerned should be notified, so that possible recovery action involving latent defects may be taken. If the beef is Government-owned, the rounds should be split to the bone, so that you can examine the surrounding tissue for a grayish discoloration. The grayish discoloration, if present, should be trimmed away and discarded, and the remainder of the hindquarter should be allowed to air out in a chill room. If no discoloration is present, airing the product in a chill room overnight will probably allow the off-odor and off-flavor associated with sour rounds to dissipate.

Abscesses. The encapsulation of diseased tissue by certain white blood cells is an *abscess.* There is a collection of puslike material present which is a result of the white blood cell activity. Abscesses are normally located on internal surfaces, but some may be found on external surfaces. Their presence indicates bacterial invasion or contamination, and they are dangerous when found in association with lymph glands, because this indicates a systemic disease. The USDA condemns entire carcasses for extensive abscesses, and the military rejects abscessed carcasses during acceptance inspections. If the product is Government-owned, smaller abscesses are trimmable, but larger ones may warrant throwing out the product.

Bruises. Bruises are blood collections associated with damaged tissue. Most bruises are superficial in nature, but some are penetrating. Since these areas are breeding grounds for bacterial spoilage, trimming is required. the disposition is normally to accept and trim, but judgment must be used in severely bruised carcasses.

Mold. Beef carcasses exhibiting *mold* are indicative of old, improperly stored products. The mold is not toxic but must be washed from the carcass. Vinegar and water are used to wash the carcass and storage area.

Cuts and mutilations. Carcasses exhibiting *cuts* and *mutilations* are produced from poor workmanship. These carcasses are subject to rejection due to poor quality. One consideration for inspectors is the effect of gross cuts on the processing of a carcass into retail cuts, since some cuts could prevent proper processing.

Anatomical Areas of Deterioration of Carcass Beef. The natural breakdown of carcass meats begins with slaughter and terminates with complete rancidity and decomposition, or else by consumption. The most important factors involved in controlled deterioration are temperature, humidity, and air cirulation during storage. If old products are delivered, rejection is in order; but acceptance with immediate issue may suffice. An important point for inspectors on acceptance inspections is that the product should not show more than normal signs of deterioration to be considered in excellent condition. This condition, of course, is a specification requirement. The areas discussed here will give sufficient indication of deterioration and can be used at origin, destination, or in storage.

Hanging tender. The *hanging tender* is located on the left hindquarter in a dressed carcass. It is exposed muscle tissue which does not drain well during bleeding and, because of its exposure, it dehydrates rapdily. With blood and serum drippings from other parts of the carcass, it may serve as a breeding ground for bacteria. Normal specification requirements are to trim this muscle to one-fourth inch, but some contracts may vary.

Jugular furrow. The *jugular furrow,* which is the pathway of the large blood vessels in the neck, is another area. The vein, which is stuck in bleeding of the animal during slaughter, is located n the jugular furrow. Blood seepage and serum in this area promotes the growth of spilage-causing bacteria. The presence of off-odor is a good indicator of deterioration.

Diaphragm. The portion of the diaphragm remaining after dressing a carcass is called the *skirt.* There is poor air circulation under this skirt muscle, and slime is often found here. The presence of slime and off-odors indicates bacterial contamination.

Flank. The *flank* folds inward as a carcass is suspended by the gambrel tendon. This fold in the flank gives the posterior abdominal region poor air circulation and slime soon develops. The situation here progresses in like manner to slime under the skirt.

Muscle surfaces. Cross-grain cut surface muscles tend to dehydrate and deteriorate more rapidly than surfaces covered with fat. Sliming and bacterial decomposition occur in these areas earlier than in other parts of the carcass. The gracilis muscle, the eye of beef, the hanging tender, and the brisket are all exposed in quartered carcasses and can be examined for soundness or condition.

Net Weight. Carcass beef is net weighed by one of two methods according to DPSC 4155.6, *Subsistence Inspection Manual.* Weighing may be accomplished at origin and destination or as deemed necessary by the accountable receiving officer. The scales must be periodically checked for accuracy, and this requirement will vary from origin to destination. Carcass beef received directly from the vendor and all other bulk items which are to be further processed must be reweighed by commissary personnel. Any shortage will be significant, and on contracts issued by DPSC, the shortage must be reported to the Contract Quality Assurance Element (CQAE), if the value of the shortage exceeds $25.00. In those cases where the shortage does not exceed $25.00, the amount of the shortage is simply deducted from the total amount on the vendor's invoice. When the produce is a locally procured item, the shortage will be deducted from the invoiced amount delivered. Products which are not to be further processed may be weighed, using the Q-allowances. The sample size must be at least 13, and significant shortages are determined by comparing the average shortage to the Q-allowance. Instead of using the Q-allowance, 100 percent inspection should be utilzied at any time that it does not impose too great a work load or cause unwarranted damage to the product. Reporting shortages using the Q-allowance is also based on those shortages which exceed $25.00 on DPSC contracts.

Product Temperature. One of the first steps performed by inspectors at destination is to take and record vehicle and product temperature. The temperature of the vehicle is often not applicable, but the internal temperature of the product is very important.

Frozen products must show no signs of having been thawed and refrozen at the time of delivery. The internal temperature at the time of delivery should be no higher than 45° F (7° C) for chilled items, 10° F (−12° C) for frozen products for export use, and 15° F(−9° C) for frozen products for domestic use. Products which are rejected because of temperature may be reworked by the vendor, provided the temperature at the time of rejection was not more than 5° F more than the maximum temperature allowed. If a contractor decides to rework the product due to temperature, that person must immediately reduce the temperature and resubmit the product. The internal temperature of reworked and resubmitted products must not exceed 40° F (4° C) for chilled products, 5° F (−15° C) for frozen products for export, and 10° F (−12° C) for frozen products for domestic use. DPSC General Article 78 provides for this working and also specifies that reworking for temperature will not be authorized unless the product meets all other contract requirements. Temperature determinations should be made by using inspection level S-3 from MIL-STD 105D, and samples should be selected randomly from throughout the shipment. it is important to maintain this temperature; therefore, keep the vehicle secured until offloading is begun.

Exercises (615):

Name the defect or condition described in exercises 1 through 8:

1. A condition defect caused from glycogen depletion prior to death.

2. Heavy accumulations of connective tissue resulting from a healed injury.

3. Two different colors on lean in the eye of beef.

4. A foul smelling defect found in the ball-and-socket joint of the hindquarter of beef.

5. Blood collections associated with damaged tissues.

6. Dark spots of hemorrhage evident throughout the tissue of the eye of beef.

7. The encapsulation of diseased tissue by white blood cells.

8. Indicative of old, improperly stored products. Provide the proper term or phrase answering each following question concerning anatomical areas of deterioration, net weight determination and temperature determinations:

9. To what must the hanging tender be trimmed?

10. Natural deterioration of item No. 102 forequarter can best be determined by examining what?

11. What is the portion of diaphragm remaining after dressing called?

12. Surface areas covered with fact deteriorate at a less rapid rate than what other surfaces?

13. When inspecting a shipment of carcass beef, you find a significant net weight shortage. What should you do in these circumstances?

14. Using Q-allowance net weight determinations, what is the least size a sample must be?

15. What should product internal temperature of a chilled product not exceed (in Fahrenheit and Centigrade)?

16. During a class 4 inspection of carcass beef, you find a sour round. What should you recommend?

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616. Differentiate specific conditions concerning deteriorative changes in fish in terms of appropriate descriptions of each.

Condition of Fish. Deterioration sets in immediately after fish are caught, and the delicate aroma and flavor of freshly caught fish are replaced in a few hours by a stronger, less agreeable odor and flavor. This deterioration continues until the product is no longer acceptable as food. Fish deteriorate in a progressive manner, going through three stages: rigor mortis, autolysis, and finally spoilage or putrefaction. Let's examine these stages as well as problems resulting from oxidative changes and parasites.

Rigor mortis. *Rigor mortis* is the apparent stiffening effect caused by the contraction of the skeletal muscles of dead animals. When normal metabolism ceases, certain acids accumulate in the muscles and cause them to contract. The presence of these acids then keeps the muscles in a contracted state. Rigor can be identified in fish by applying finger pressure to the surface, forming a dent. When the pressure is removed, the depressed spot will regain its original shape. Authorities attribute this stiffening to biochemical reactions with the muscle. While the theories on rigor mortis make interesting study, your concern is the practical use of rigor mortis in the fish industry; for example: Is rigor mortis good? Bad? How long does it last? What do handling procedures have to do with its occurrence? Let's examine rigor mortis in the light of our interest.

Is rigor good or bad? For the fish industry, rigor is a very desirable state. The acidification of muscle that occurs during rigor exerts a beneficial bactericidal effect. Hence, spoilage from bacterial action is reduced and held in abeyance. Thus, from this standpoint, rigor aids in maintaining storage quality. If of sufficient duration, the fish can be processed during the rigor state and will withstand longer storage. A prolongation of rigor mortis, consequently, is of great economic importance.

How long does rigor last? Rigor mortis lasts longer when the fish has exerted little muscular activity prior to death and is refrigerated immediately after being caught. Handling before and during rigor mortis should be minimal. Rigor can be prolonged by maintaining fish at or near 32° F (p° C) for up to 120 hours.

How do handling methods affect rigor? When fish are netted, they panic and struggle for a relatively long period of time. Fish caught in such a manner enter rigor very soon after death, depart from the condition rather quickly, and have a relatively short storage life. If the fish are landed with a minimum of struggling or are killed immediately after boating, so that predeath activity is minimal in duration and violence, they have a longer term of rigor and keep better.

Autolysis. *Autolysis* is a spontaneous disintegration of cells by the action of their own enzymes; it begins immediately after death. If the fish in question are eviscerated and beheaded, the degree of enzyme-caused spoilage is reduced. If they are left in the round (not dressed) as are ocean perch, the possibility of spoilage is very real. Chemical methods of testing for autolysis are complex and have not proven to be reliable. Therefore, we are forced to fall back on the organoleptic or sensory means for evaluating the degree of spoilage. thus, when inspecting the more susceptible species, check for autolysis in much the same manner as for bacterial spoilage—smell them.

Putrefaction. This is a state or stage of relative lack of freshness. For a better understanding of freshness, it is best that we consider all stages; fresh, stale, and putrid. What we want is the best quality of fish available. We accept fish for processing in either rigor or early autolysis. We will *not* accept fish that are in advanced autolysis or that are putrid. Advanced autolysis can best be deteced by smell. The fish's body has begun, basically, to digest itself as the enzymatic action that is occurring begins to breakdown the tissue and will, eventually, lead to putrefaction.

Putrefaction means simply that the fish is decaying. The item will display all of the signs normally associated with a decayed food: strong, repulsive odor, slime and perhaps mold growth on the exterior scaling, excessive loss of scales, a lack of springiness to the flesh, and a major change in color.

Whether the fish in question is in advanced autolysis and is merely carrying a strong odor, or is putrifying and shows all of the signs just mentioned, the item is not acceptable for purchase. If the fish is in the advanced autolysis stage, you may be able to salvage it. Contact your base defense property disposal officer (DPDO) to be certain. If the item is being delivered in either of these conditions, recommend rejection immediately.

Oxidative changes and rancidity. Oxidative changes primarily affect the fat content of the fish flesh. Oxidation causes a lowering of quality. At the time of death, fat-splitting enzymes are released and may free or break down the fat. Unsaturated fish fat will oxidize even though frozen, and you must inspect for such an occurrence. Perhaps the first indication of oxidation is rancidity. Rancidity results in a bitter flavor which leaves a tallowy, soapy taste and a strong and pungent odor. The color of the fat changes from the normal clear to yellow and then to brown.

Exercises (616):

1. Match each condition in column B with descriptive statements in column A by placing the correct response in the space provided in column A. Each column B response may be used once or more than once.

Column A

____(1) A spontaneous disintegration of cells due to actions of their own enzymes.
____(2) Relative lack of freshness.
____(3) Stiffening caused by contraction of muscle bundles.
____(4) Condition which may be prolonged by storage at or near 32° F.
____(5) Condition which results in a bitter flavor and pungent odor.

Column B

a. Rigor mortis.
b. Autolysis.
c. Putrefaction.
d. Oxidative changes and rancidity.

1-6. Packaging, Packing, and Storage

No matter how well a product is processed or even stored, if it is in an inferior package or container, the product can become contaminated by its environment. Accordingly, even though the product is well packaged, if it is not properly labeled or marked, the consumer cannot identify its contents.

617. Identify general procedures relating to packaging and state its purpose.

Packaging and Packing. Foods must be packaged (placed in an individual container or can) and then packed (several packages made ready for storage and shipment) in various ways so that wholesome foods can be delivered to military installations all over the world. Your job will necessitate an ability to recognize markings and labeling, and, in some instances, the capability to inspect for proper packaging and packing in terms of the contract. There is a tendency to overemphasize the inspection of food and to underemphasize the inspection of the package or contained. In this section we will look, in a broad general sense, into the purpose of packaging, discuss the types of packages, and then take a brief look at the materials used to pack the packaged products.

Purpose and types of packaging. Foods for military consumption must be stored in all kinds of climates. The package protects the food and serves as a convenience in using and handling. The package or container must protect the food from moisture, excessive heat and cold, insects, rodents, some pressure from weights in storage, acids, alkalies, oils and damage caused by rough handling (it is evident that the packing aids many of these protective functions). Yet the container must not impart any odors, tastes, or toxic material that the food can absorb. A perfect package has not been developed, but new developments tend toward increased tensile strength, lighter weight, and increased tensile strength, lighter weight, and increased resistance to vapor, to temperature variations, and to flammability. For convenience to the military services, the weight, strength, and size of the container are important. Consideration must be given to reduction in shipping costs, to shipping problems encountered in moving products from warehouses to using facilities, and to the placement of the products onto shelves and into the refrigeration equipment of dining facilities. Individual containers must be easily opened with standard Air Force dining hall equipment. Packages must be labeled for proper dining hall identification.

The individual packages easily fall into two general categories—*rigid* and *flexible.* Tin cans are still the most prevalent form of container used in packaging, but they are being replaced by the aluminum can and by the glass container, which is also classified as a "can" in a broad sense: "a jar for packing or preserving fruit." Cans may also be classified as to method of filling. An example of the vent-filler can is an evaporated milk can, spot-soldered on the end at the spot where the milk is injected. An example of the hole and cap is the Log Cabin Syrup can or the Wesson Oil container. An example of the sanitary can is an ordinary can; for instance, a normal tin can constructed of cold-rolled steel coated with tin and soldered at the ends. As has previously been pointed out, cans are enameled to protect the product. Can sizes are usually expressed as two three-digit numbers, with the first referring to the diameter and the second to the height. The first digit of a can size reflects the whole number of the size, in inches; the next two digits, the fractional inches in sixteenths. Thus, a can size "401 x 412" is a can whose diameter (first three digits) is 4 and 1/16 inches, and whose height (second three digits) is 4 and 12/16 inches (4¾ inches). In the example "401," note that the zero is used as a filler.

Flexible packaging materials are numerous. Of interest is the imperviousness (not allowing passage) of the material to light, gas, or water vapor. Let's start with one of the earliest wrappers developed, waxed paper. If it is waxed on only one side, it is considered impervious only to water vapor. Aluminum foil is impervious to vapor, gas, and light, but it is not considered good as a commercial wrapper unless laminated to other materials, because it loses imperviousness when wrinkled (it cracks). Cellophane is not tough and is water pervious. It is oxygen and gas impervious until wet. Since meats must be packed so that oxygen can get in and permit breathing, cellophane is often used, because the meat juices wet the cellophane enough to permit the passage of oxygen. Cellophane is often laminated to other wrapping materials. Saran is a wrapping material impervious to everything. Polyethylene is tough and water impervious, but it is pervious to gases and is shrinkable. On the other hand, polyvinyl chloride is pervious to oxygen, is strong, is water impervious, and does not shrink. Mylar (scotch-pack) is a wrapping used when foods are to be cooked in the package. It is the strongest, most resistant of the flexible packaging materials, is a chemical repellent, and is water and gas impervious. Amino acids can be synthesized into any meat or container, creating an interesting flexible packaging material, a synthetic protein film. when it is used to wrap foods (such as sausages), the consumer actually eats the package!

Purpose of packing and packing materials. Packing is the grouping of a number of small packages or units into one larger unit or pack, using such materials as are necessary to protect against mechanical damage, loss, pilferage, dirt, contamination, moisture, and other conditions that may affect the wholesomeness or storage life of foods.

The packing materials used are paper, cloth, wood, metals, and synthetics, such as fiberboard. Packs include boxes, crates, bales, bundles, sacks, bags, drums (metal or fiber), fiber cans, wooden barrels and kegs, miscellaneous packs, and palletized unit loads.

Marking. Marking for shipment and storage is in accordance with applicable military standards but, in general, for perishable subsistence, it conveys this information:

- Item description and grade (or brand).

- Quantity, size, unit, and total net weight.
- Gross weight and cube.
- Date packed (month, day, year).
- Contract or purchase order number; name and address of contractor.
- Special markings.

The standard markings for perishable subsistence do not apply to fresh fruits and vegetables. These markings are made as specified in the contract or purchase order.

Exercises (617):

1. Packaging must protect food and not impart what that can be absorbed by the food?

2. In addition to providing protection for food, what other two requirements must the individual container meet?

3. Describe a 401 x 412 can briefly.

4. Cellophane allows for the passage of oxygen when it comes into contact with what?

5. What is the primary purpose of "packaging"?

618. Distinguish various acceptable practices from nonacceptable ones.

Cold Storage Practices. More than half of the military ration consist of perishable items that require refrigeration. You will inspect the following foods in a cold storage environment:

a. Fresh and frozen meats and meat products.
b. Fresh and frozen fish and other water-food products.
c. Poultry, eggs, and dairy products.
d. Fresh fruits and vegetables.
e. Other frozen foods.

To reflect job practices, we will briefly review the functional parts of a cold storage plant and discuss general storage practices that are essential for well-informed inspectors to know.

Let's visit a typical cold storage plant and look at the freezer storage room, the meat chill room, the cooler rooms, and the ventilated storage room.

Freezer storage room. Ideally, you will find the freezer storage room maintained at a temperature of 0° F to −10° F (−23° C to −18° C) with a minimum of temperature fluctuation. All food items that are frozen when received are stored here. Especially watch for subsistence items that deteriorate in prolonged storage, such as pork, sausage, frankfurters, salami, precooked frozen in-flight meals, TV dinners, and precooked frozen in-flight meals, TV dinners, and meat pies. These items must be stored at temperatures no higher than −10° F, (−23° C) if at all possible. If you notice food products stacked with stripping (pieces of thin boards) between tiers, it may indicate that the food product was received at 20° F (−7° C) or above and was, therefore, specially stacked to insure a circulation of cold air around the containers. Stacking will be further discussed later. Other foods received at below 20° F (−7° C) are normally piled into compact stacks without stripping between tiers.

If you find the contents of a container removed and scattered, it probably indicates that a product was received partially defrosted. It was scattered so that it would refreeze quickly, as any accepted partially defrosted item must be refrozen without delay. You may find a fan being used to circulate the cold air rapidly in such cases. If not, recommend such practices if they are necessary. You should also make sure that these refrozen foods are always marked in some way, so that the refrozen lot can be issued before other products in the same category are used, since those that were refrozen have a markedly shortened shelf life. Good inspectors insist that frozen beef carcasses be hung if at all possible. Under no normal circumstances do wholesome practices permit foods to be frozen (originally) in the freezer room, since freezing takes place too slowly and results in a product of inferior quality.

Meat chill room. As we continue our inspection tour, we enter the meat chill room (or rooms). Notice that the temperature is maintained at 32° F to 35° F (0° C to 2° C). Suppose that an error has been made, and the temperature is held below 32° F (0° C). Slow freezing of the product would result, and you could expect to find discoloration and loss of quality in the product; but this is a rare occurrence. Normally, you can expect to find the following items stored in the meat chill room: fresh meats and meat products, fresh poultry, and smoked or salted ham and bacon. Fresh pork and pork sausage need a lower storage temperature. If, as is often the case, this is the only meat chill room available, the pork should be stored in the coldest part of the room for no longer than 48 hours. Also, a good inspector will be alert to guard against other practices endangering the wholesomeness of this product.

Cooler rooms. On an inspection tour you will normally find at least two cooler rooms. Dairy products, eggs, lard, and lard substitutes are stored in one room; while, to prevent the transfer of taste and odors, fresh fruits and vegetables are stored in another room. (This excepts those less perishable items stored in the ventilated storage room.) You should find both cooler rooms maintained at 35° F (2° C), and again the temperature should not be allowed to fluctuate. Careful control of the velocity of the refrigerated air is necessary. Dehydration and damage to the stored food are points to look for on inspection and could indicate excessive air velocity. If your base does not have a ventilated storage room, or if it is not using it to store such items as cucumbers, eggplant, and tomatoes, make sure that the fruit and vegetable room mentioned below is not held below 40° F (5° C). Temperatures below 40° F (5° C) can damage some fresh vegetables.

Ventilated storage room. You will usually find the less perishable fruits and vegetables, such as potatoes and apples, stored in a well-ventilated storage room. Sometimes refrigeration is available, although in cold climates it is at times necessary to heat the room to prevent the temperature from dropping below 38° F (3° C). The room is preferably maintained at 40° F (5° C). If white potatoes are stored at a temperature below 40° F (5° C), they will develop a sweet taste, so keep this in mind while inspecting. Common foods that you may find stored in ventilated storage are apples, avocados, beets, citrus fruits, cucumbers, eggplant, dried fruits, honey, canned meats, honeydew melons, onions, parsnips, pears, peppers, potatoes, pumpkins, squash, tomatoes, turnips without tops, and canned, evaporated milk. The following points are of interest to you as an inspector:

a. Food is stored here only to lengthen its shelf life.

b. Temperature control is involved as well as ventilation (honey, canned goods, etc.).

c. Pinpointing caused by condensation forming on cans may denote inadequate ventilation.

d. Honey turning to sugar denotes improper (too low) storage temperatures.

Space availability is a factor in placing a product in the ventilated cold storage room.

Factors Affecting Cold Storage. What factors that accelerate spoilage can you help control in your inspection? Consider the following:

a. Lack of heat withdrawal from the product shown when packages are not adequately spaced.

b. Rough handling (not much you can do).

c. Incorrect humidity (some items need more than others—if the situation cannot be controlled, recommend that these items be issued at an earlier time).

d. Mildew resulting from too much humidity (recommend that the door be kept closed as much as possible, and if mildew is still a problem, scrub the walls with detergent and water, followed by a plain water flushing—then by a flushing with quaternary ammonium compound or, if it is not available, with clorox solution).

e. Lack of ventilation (control the height of the stacks off the floor and the distance from the walls, and use stripping).

f. Crushing (recommend that bags not be stacked more than four or five high).

g. Insure stock rotation (this is probably the most important existing warehousing provision; FIFO—first in, first out—should be everyone's byword).

h. Fluctuating temperatures (examine the temperature records).

i. Defrost units (determine if defrosting was adequate).

General storage practices. There are general practices and terms concerning stacking, dunnage, and ventilation. *Stacking* is the placement of packaged items and carcass meat in neat, compact stacks with a space of 4 to 6 inches between the food and the wall, and 18 inches between the top of the stack and the ceiling. *Floor dunnage* (2 × 2-inch strips of wood or metal) is frequently used to keep food products from touching the floor and to allow air circulation beneath them. The amount of ventilation necessary depends upon the commodity stored. For instance, fresh fruits and vegetables require ventilation in the stack, although cases or boxes can usually be stacked so that there are ample air spaces in the stacks. Shell eggs in wooden cases need not be stacked with wooden stripping, if they are stored only a few days; but if they are in fiberboard cartons or are to be stored longer than a few days, the tiers must be separated with wood stripping. Tiers of boxes or cartons containing fresh meat products must be separated with stripping of thin boards or laths.

Frozen meats, meat products, poultry, fruits, and vegetables received at temperatures below 20° F (−7° C) and solidly frozen are correctly stored for stack ventilation if the dunnage on the floor is at least 2 inches thick and the product is stored 4 to 6 inches from the wall. As it was indicated earlier, items received at temperatures higher than 20° F (−7° C) are correctly stacked with stripping.

Exercises (618):

Identify each true statement about cold storage in exercises 1 through 6 as "T" and each false statement as "F." Explain why the latter are false:

T F 1. Freeze storage items received at a temperature of 25° F should have stripping between tiers to insure circulation of cold air.

T F 2. Items received partially defrosted should be removed from the container and scattered about the freeze storage room.

T F 3. Refrozen foods should be marked so the refrozen lot can be issued first.

T F 4. Fresh pork should be stored in the coolest part of the meat chill room.

T F 5. Apples and eggs should be stored in the same cooler at 35° F.

T F 6. Pinpointing indicates inadequate ventilation in the ventilated storage room.

619. Identify valid dry storage practices.

Dry Storage Practices. *Nonperishable subsistence* can generally be defined as foods that can be stored without refrigeration and includes canned goods, sugar, flour, condiments, cereals, preserves, salt, and dehydrated foods. The Environmental Health Service inspects storage facilities for sanitation and adequacy for the preservation of all subsistence. Points to check when you are inspecting nonperishable storage facilities are the use of pallets, heating facilities, ventilation, security, insect and rodent control, storage charts, markings, and epidemic spoilage. We will discuss each of these items and some other general dry storage practices.

Use of pallets. Pallets are usually 40 × 48 inches in size. Cargo pallets which may be used to store heavy materials may be 48 × 72 inches. Pallets are designed so that forklifts can move them with their contents, and must be sturdy enough to withstand the weight of the foods stored. You must also inspect another type of pallet, the *box pallet*, which has a standard pallet base with a vertical and top framework. This pallet is designed to store odd-sized and odd-shaped containers, or containers that are easily crushed, so observe them for evidence of crushing. You need to check the air space under the pallets for adequate cleanliness and to see that provision has been made to implement effective rodent control. There should be enough space for placing rodenticides.

Heating and ventilation facilities. Most dry storage warehouses must be heated during cold seasons. An inspector must be observant because glass containers and liquid canned goods are particularly vulnerable to freezing. Some dry canned goods containers can withstand freezing. Freezing, however, can cause undesirable changes in appearance in the food, and can cause cans to burst. On the other hand, in warm weather, storage buildings must be adequately ventilated. This may be done with vents and windows; if necessary, exhaust fans may be used.

Security. All dry storage facilities should be locked when the building custodian is absent. Loading and unloading doors should have an overhead light for use during hours of darkness. Sensitive food items are usually stored in a room that is kept locked. Outside windows are covered with chain link security fence or iron bars. As a precautionary measure, you should have the commissary building custodian's permission to enter a building to perform your inspections.

Insect and rodent control. The first step in insect and rodent control is to insure that no subsistence is infested with rodents, weevils, or other vermin. Such products as flour, dry beans, rice, raisins, macaroni, spaghetti, noodles, and cereals are particularly vulnerable to insect infestation. When performing an inspection, you should check the housekeeping procedures, the rodent-proofing, the frequency of stock rotation, and evidence of insects and rodents. If insects and rodents are found, you should report this, along with your written recommendations about their control, to the commissary officer.

Storage charts and markings. Charts showing the storage life of nonperishable subsistence are found in AFCOMSR 145-2, *Store Operations*. Food containers without a packing date should be stamped to show the date that they were received. This tells you how long the product has been in the warehouse and is a means of controlling proper stock rotation.

Epidemic spoilage. This is spoilage that occurs when a can (or cans) in a stack of cases ruptures and the contents leak on cases and cans that are stored below. The leakage spreads laterally and downward in a bell shape. Whenever epidemic spoilage is detected in a stack of subsistence cases, the spoiled cases and cans must be removed immediately so that further spoilage does not occur. The spoiled contents of the ruptured cans will spoil other cans when it spills on them.

General dry storage points. As a food inspector, consider the following points:

a. Again, proper stock level control, along with FIFO (first-in, first-out), are mandatory practices. They must be conscientiously checked by inspectors and followed by warehouse personnel.

b. Don't stack too high.

c. Insects and rodents ruin the wholesomeness of dry foods in storage.

d. Check for ruptured cans and pyramids of epidemic spoilage.

e. Check for mold.

f. Stack 6 to 8 inches away from wall.

g. Don't stack closer to the ceiling than 18 inches.

h. Keep food stacks off the floor.

i. Avoid stacking in front of windows or any other source of heat.

j. Close doors on wet days; open them in dry, sunshiny weather.

k. Write to the company and secure its codes to interpret the pack date of its standard brands.

l. Destructive sampling is at commissary expense.

m. Provide a receipt for samples taken for testing. Use DD Form 1222 for all samples pulled. This form can be used for commissary, dining hall, AAFES and NAS samples.

Exercises (619):

Identify each true statement about dry storage practices in exercises 1 to 6 as "T" and each false statement as "F." Explaing why the latter are false:

T F 1. The space under pallets should be checked for adequate cleanliness.

T F 2. Glass containers and cans containing liquids are not vulnerable to freezing.

T F 3. Evidence of insects or rodents in dry storage foods should be reported to the commissary officer.

T F 4. The packing date of subsistence is an effective means of controlling stock rotation.

T F 5. Epidemic spoilage in a stack of canned goods is caused by cockroaches.

T F 6. When samples are taken, a receipt should be provided.

620. Pair terms concerning canned food defects with phrases that best describe them and classify each defect as major or minor.

Canned Food Defects. Damaged cans occur in shipping and handling, due to spoilage, and due to deterioration and chemical breakdown of the product. As you make routine acceptance and surveillance inspections, as well as the Class 7 inspections at the commissary resale store, you will find defects in canned foods. These defects can result in an actual defective can, a distended or abnormal appearing can, or a can that appears normal but has food spoiled inside.

Defective cans. A visual examination of a primary container includes its type, style, size, condition, exterior coating, and labeling. Dents in cans are described by such terms as "body dents," "end seam dents," "buckled seams," and "paneling" (caused by excessive vacuum). You must consider *major* and *minor defects*. A major defect is one that can result in failure or materially reduce the usability of the unit. A minor defect does not materially reduce the usability of the unit; it either limits its serviceability or is a departure from the established standard—a departure that has no bearing on the effective use of the unit.

When you perform an in-storage inspection, the primary consideration is the condition of the product. If you are performing an acceptance inspection, the percent of major and minor defects becomes an important and controlling factor. DPSC Manual 4155.2, *Standard Classification for Can Defects (Visual Inspection Gage Set No. 33A-2D)*, the AMS (Agriculture Marketing Service) Handbook, *Exterior Condition of Filled Food Container*, U.S. Department of Agriculture, pictures both the upper and lower limits of major and minor can defects. For instance, any severe body dent (deep and sharp dents with sharp angles to the points) is classified as a major can defect; so is a severe body dent involving an end seam with possible disruption of the hermetic seal. A moderate body dent involving an end seam is classified as a minor defect. Your supervisor can help you acquire skill in further identification of body dents in cans.

Distended Cans. There are other defects that relate to distended cans, all of which are normally classified as major. The descriptive terms "flipper," "springer," and "sweller" are used rather loosely by the canning trade. A "flipper" is a can that has too little vacuum. The can appears normal until struck on a flat surface. The blow causes the opposite end to distend until forced back into position. The causes of this condition are overfilling, insufficient exhaustion, or either chemical or bacterial action. "Springers" and "swellers" are more easily located and are predominantly caused by gas formation. A *springer* is a can with one end distended. If the distended end is forced in, the other end will distend. A *sweller* can has both ends distended. Varying degrees of internal pressure are denoted by such descriptive terms of visible-can defects as "soft swell," "hard swell," "buckled," and "peaked." You must determine the wholesomeness of the canned products where any of the above defects are found. You must act according to regulations as to the use or disposition of the affected cans. Some amplifications that better explain the causes of swelling are as follows:

a. Hydrogen swells are caused by a reaction between acid foods and the metal can, releasing hydrogen gas.

b. Carbon dioxide swells are usually produced by microorganisms growing in the canned food. Ordinarily they are nonpathogenic; but, occasionally, as in the case of botulism, they may be pathogenic.

c. Carbon dioxide distension is a result of the breakdown of the canned product. It is a very common occurrence in canned syrups and molasses. For some unknown reason, but perhaps because of the high carbohydrate content, these items break down and release carbon dioxide, which causes the cans to swell. This type of sweller is not harmful and does not make the product unacceptable.

d. Mechanical distension means that internal pressures cause stress on the can. This can result in bulging and, in severe cases, ruptured seams.

e. Filling errors produce cans that have been slightly overfilled and/or that were not adequately preheated to evict the gas or where not adequately vacuumized.

f. Distension from differential altitude occurs occasionally when small, flat-type cans (sardine cans, especially) are filled at sea level and are then shipped to a much higher altitude. This is not harmful as far as product quality goes.

Normal appearing cans. In any open-can inspection, usually used in conjunction with statistical sampling (covered elsewhere in this course), you may discover the following defects:

a. Soured contents (flat souring, usually caused by thermophiles; contents develop excess acid without the formation of gas).

b. Black contents (caused by the reaction of sulfur and steel, or of steel with sulfur-producing bacteria).

c. Spangling (tin reacts with the food components, appears as little dark blotches on inside of cans, does not aversely affect food, often seen in cans of tomatoes).

d. Texture, color, or taste of food is "off," (evaporated milk must be rotated and periodically inverted to prevent settling and appearing grainy).

e. Pinholes (small and at first invisible), which mean that the contents of the can are contaminated from the outside. Gas, but not necessarily liquids, escapes through pinholes. Since pinholes usually occur around the groove of the seam, running the point of a ballpoint pen along this juncture will often puncture them or allow you to feel a defective area.

Exercise (620):

1. Match each term in column B with the phrase in column A that is most appropriate for that term and, for each, state whether the phrase describes a major or minor canned defect or is not classified. Some terms may be used more than once.

Column A	*Column B*
___ (1) Slight end seam dent.	a. Springer.
___ (2) One end of the can is distended severely.	b. Spangling.
___ (3) Deep sharp dent with sharp angles in side of can.	c. Body dent.
___ (4) Carbon dioxide distention.	d. Pinholes.
___ (5) "Peaked."	e. Sulfur.
___ (6) Severe dent in end seam.	f. Sweller.
___ (7) Tin reacts with food.	
___ (8) Small and invisible.	
___ (9) Black contents.	

621. Differentiate terms concerning dried food defects with regard to the definition or phrase that best describes each.

Dried Food Defects. Many dried products in the dry storage warehouse require inspection. Examples are cereals, dried fruits, and candies. All previous precautionary statements regarding temperature, humidity, and stock rotation (especially) apply as firmly to these products as they do to those in cans. The greatest hazard to dried products is insect infestation. However, dried foods do develop other specific problems that are not seen in canned foods.

Case hardening. This refers to the shrinkage and sealing of the surface of a food piece which occurs when there is a very high surface temperature and unbalanced drying. The result is a hard outer wall with moisture remaining on the inside of the food piece.

Hard core. Seen in freeze dried foods, this is similar to case hardening. However, in this defect the center of the freeze dried food is hardened due to incomplete dehydration. The outer portion of the food is the typical porous, light product expected in freeze dried products.

Glaze and scorch. Also in freeze dried foods, these defects result when the vacuum and heating combination in the freeze drying process allow the product being freeze dried to thaw on the surface. If the temperature thaws the surface, the defect is glaze; if the heat is excessive and the surface actually browns, the defect is a scorch.

Browning and rancidity. These are chemical reactions resulting in dried foods in storage. *Browning* is an enzymatic breakdown of amino acids and sugars, and *rancidity* results when fats in the product are oxidized.

Exercises (621):

1. Match each term in column B with the phrase in Column A that is most appropriate for that term. Column B terms may be used once or more than once:

Column A	*Column B*
___ (1) Temperature thaws surface.	a. Insect infestation.
___ (2) Temperature browns surface.	b. Case hardening.
___ (3) Enzymatic breakdown.	c. Hard core.
___ (4) Incomplete dehydration.	d. Scorch.
___ (5) Oxidized fats.	e. Glaze.
___ (6) Greatest hazard to dried products.	f. Rancidity.
___ (7) Unbalanced drying.	

622. Identify valid important characteristics of frozen food defects.

Frozen Food Defects. Frozen foods may deteriorate as a consequence of too high temperatures and fluctuating temperatures, improper humidity, microorganism growth, enzyme activity, chemical reactions, or a combination of any or all of these. We will briefly discuss each of these spoilage factors.

Too high storage temperatures and fluctuating temperatures. If frozen foods are to be stored for their maximum stored life, the storage temperature must be optimally low and constant. Temperature fluctuation causes conditions very similar to those that occur during slow freezing, since it produces large ice crystals and the attendant nutritional deterioration. Depending upon their extent, the fluctuations may also accelerate enzymatic and chemical reactions.

Improper humidity. In the case of variations in relative humidity, when humidity is too low, insufficient moisture dries the stored food. In freezers, the effects of humidity changes are difficult to control by any means other than suitable packaging. When the humidity is below optimum, freezer burn results if the packaging is not intact. While freezer burn is a harmless condition, it is esthetically unacceptable and is irreversible.

Microorganism growth. Even though freezing can slightly decrease the number of vegetative organisms, their number can increase again when the food is thawed if it is not stored under conditions suitable for any fresh product.

Enzyme Activity. Freezing stops the action of most enzymes but does not destroy them. When food is restored to normal temperature, the enzymes resume their activity. Enzymatic action may lower the vitamin content and food value and change the texture, appearance, and flavor of food.

Chemical reactions. These are also reduced as food temperature is lowered. Such reactions include color changes, fat oxidation (rancidity), vitamin destruction (by oxidation or other reactions), flavor changes, and many others. Remember that chemical reactions do continue in frozen foods, but at a slower rate. This is the reason that even those frozen foods stored under optimum conditions do not retain their quality indefinitely, but, instead, slowly deteriorate to the point where they are unacceptable to the consumer. Both excessive dehydration and freezer burn can accelerate oxidation, since the removal of water from the surface tissue permits oxygen penetration to a greater depth within the food. Hence, there may be very pungent areas of rancid fat immediately under the freezer-burn area. Again, the best prevention is optimally low and constant frozen food storage temperatures.

Combination spoilage factors. Regardless of the storage temperature, freezing cannot reverse damage already done to foods. Food keeps its own history—a cumulative record of damage done to it. In storage, the damage continues at a greater or lesser rate, depending upon the storage temperature. As shown in the following chart, the lower the temperature, the longer it takes for a food to develop a slight lessening of quality. (NOTE: The chart is a typical example only and cannot apply to all foods, since many of them will retain quality longer than 2 or 3 days, even though stored above 20° F (−7° C))

Storage Temperature	Time Required for Slight Lessening of Quality (Off-Flavor)
0° F (−18° C)	1 year
5° F (−15° C)	5 months
10° F (−12° C)	6 weeks
15° F (−9° C)	3 weeks
20° F (−7° C)	1 week
Above 20° F (−7° C)	2 to 3 days

Before leaving the storage of frozen foods, let's point out several additional important facts:

a. The longer the storage, the larger the ice crystal, so remember FIFO (first in, first out) for all frozen items.

b. The greater the temperature fluctuation, the larger the crystals, so make certain that freezer doors are kept open no longer than absolutely necessary.

c. Freezing food will not reverse damage already done, so don't try to freeze partially spoiled food to rejuvenate it.

d. No microorganisms will grow in ice crystals, but they will grow in the unfrozen fat of some frozen meats.

e. Any microorganisms that grow in foods while they are frozen are not pathogenic; they make the food taste bad, but they are not injurious to health.

f. In the freezer, nutrient loss is progressive and sure—beef and nonfatty fish are good for 6 to 7 months, and fatty fish are good for 5 months (under ideal storage conditions).

g. Don't load an open-top (display-type) freezer unit above the load line arrow. The top layer may thaw.

As we have already pointed out, foods should be frozen rapidly so that the ice crystals are small, cell walls remain unbroken, and the cells retain most of their moisture. But what about thawing? Frozen beef and pork should be thawed slowly in the refrigerator so that the cells have time to reabsorb any moisture they have lost during freezing. Fish should be thawed rapidly, preferably by cooking, since slow thawing may denature fish protein. Thawing by cooking is a must for frozen vegetables and certain fruits. Some meat, too, may be cooked from the frozen state provided it is started directly from the frozen state.

Now consider accidental thawing and what you can do about it. On occasion, frozen foods may thaw while in transit. In other instances, thawing results from electrical power failure or from the mechanical failure of a freezer. In either event, if failure is likely to be prolonged, dry ice (if available) should be used to keep the foods frozen. If frozen foods begin to thaw in spite of precautions, what should be done with them? Should they be refrozen? The answer to this question depends upon the internal temperature of the foods, the length of time they have been at this temperature, and the type of foods. With nondangerous items such as plain fruits and vegetables, or highly acid items like sauerkraut, the length of time outside proper storage temperatures is not as critical as it would be for more dangerous food items. In this respect, such foods as creamed meats and some creamed vegetables are very dangerous and have narrow margins of safety. If the internal temperature has gone over 45° F (7° C) for over 3 hours, condemn the food.

When you know that the particular food is one that would not spoil in the period of exposure to improper temperature, the food should be force-issued and used within 24 hours as a chilled-food item. If the food is still solidly frozen but its internal temperature ranges upwards to 20° F (−7° C), it should be placed in another freezer and the temperature taken back to 0° F (−18° C), or to whatever is optimum in your warehouse. The food should be identified by suitable markings so that it can be issued ahead of similar products that have not been distressed by being partially thawed by fluctuating temperatures.

Exercises (622):

Identify each true statement about frozen food defects in exercises 1 through 5 as "T" and each false statement as "F." Explain why the latter are false:

T F 1. Large ice crystals are caused by temperature fluctuations.

T F 2. Freezing greatly reduces vegetative organisms.

T F 3. Freezer burn may actually slow oxidation.

T F 4. Very low storage temperatures tend to correct damage already done to meat products.

T F 5. Meat should be condemned when the internal temperature is 43° F after thawing for 2 hours.

1-7. Dairy Products

The nutritional value of dairy products and the important part they play in our society is well known. So we'll not discuss the obvious. Instead let's consider the fact that dairy products are consumed in greater quantity than any other nutritional food item and are an excellent media for bacterial growth. Dairy herds are examined periodically for zoonotic diseases, and from the time of milking until the product is consumed we exercise controls to protect the quality and particularly the wholesomeness of this product. It is essential, therefore, that you become thoroughly familiar with the procurement quality assurance procedures we will discuss in this section.

623. Identify various valid inspection responsibilities of the dairy quality assurance program.

Inspection Responsibilities. You may be involved in any of the aspects of the overall military inspection plan, depending upon the responsibilities of the base office to which you are assigned. Whatever your job, though, you will need to have a good knowledge of the product requirements set down by the military. These requirements can be found in a variety of publications, including contracts; specifications; the *Grade "A" Pasteurized Milk Ordinance (PMO)*; AFR 74-15, *Procurement Quality Assurance for Fresh Dairy Products*, Appendix A; as well as various contracts let by the military. The sources of information you will use most frequently will be Appendix A of AFR 74-15 and the applicable contracts. The contract usually consists of the primary contractual document accompanied by and/or referencing other related documents. Collectively, the contract and the referenced (or attached) documents make up the purchase instrument. The documents which might be referenced or attached to a contract are the: (1) Subsistence Master Solicitation (SMS), for Fresh Milk, Ice Cream, and Related Dairy Products, (2) Federal and Military Specifications, (3) USPHS Pasteurized Milk Ordinance (PMO), and (4) DPSC clauses, articles, conditions and special provisions.

We cannot overemphasize the importance of contracts or any of the inspection documents. If you lack an understanding of what constitutes inspection documents or if you cannot interpret them, you will fail as an inspector.

There are two inspector positions necessary to properly implement procurement quality assurance: (1) the origin inspector, and (2) the destination inspector. Military veterinary inspectors from the US Army fulfill the duties of origin inspection for the Department of Defense, and Air Force environmental medicine specialists assigned to food inspection duties fulfill the role of destination inspector.

Origin inspector. The origin inspector is responsible for submitting dairy samples to a laboratory, interpreting results of laboratory tests, maintaining quality histories on the products they are responsible for, and coordinating with other agencies involved in the procurement and inspection of dairy products. In essence, this inspector is the key to the success of the dairy inspection program.

The first three of these origin responsibilities (submitting samples, interpreting results, and maintaining quality histories) are routine in nature and will be discussed later in this chapter. The last of these responsibilities, coordinating with other agencies, is probably the most difficult and important part of the dairy program.

Most dairy contractors are not equipped to produce all products, contracted for, in one plant location; therefore, there may be more than one origin inspector for any one contract. There is no need for the origin inspectors to communicate results with the other origin inspectors involved in the same or other contracts. For example, suppose the origin inspector at a subcontractor's plant finds that two of the last four consecutive tests for coliform in chocolate milk are nonconforming. This origin inspector would orally notify the prime contractor and subcontractor, following this with a written letter, an HSC Form 008 Notification of Non Compliance of Fresh or Frozen Dairy Products.

Information copies of the letter would also be sent to the applicable CQAE, HQ HSC (Health Services Command), and other agencies as warranted or directed. Other origin inspectors are not notified. Actual suspension of a product (3 out of 5 nonconformances) would require the origin inspector to inform all destination inspection agencies so that they do not accept products that have been suspended from delivery.

Before a new dairy contract begins, the origin inspector should send a DD Form 1232, Quality Assurance Representative's correspondence, to all contract destination inspectors. Addresses and phone numbers for destination inspectors can be found in the most current letter, "Location of Military Veterinary Personnel Available for Inspection and Services," published by the Office of the Surgeon General. Origin inspectors should inform the destination inspectors of the contract(s) and product(s) they have responsibility for and that any problems noted at destination with said products are to be reported to them in accordance with AFR 74-15, Appendix A, paragraph 5-2. Other information to include on this form are the tare weights and product codes for the product(s) they are responsible for inspecting.

Problems reported to the origin inspector by the destination inspector—i.e., short weights, excessive leakers, etc.—will require coordination with the contractor or subcontractor to resolve problems more expeditiously.

Destination inspector. The destination inspector's duties comprise an integral part of the quality assurance of fresh dairy products. Routinely, you should perform the PQA (Procurement Quality Assurance) procedures required at destination. These procedures are directed by AFR 74-15, Appendix A; and you have the responsibility of initiating these procedures on each new contract. We will discuss these specific procedures in a later section.

You may be stationed at a base that additionally is responsible for collecting and submitting samples to an Army medical laboratory. Whether the sampling is performed at origin or destination is determined by HQs HSC based on the "most efficient use of Government resources." For example: The contractor's plant may be located 30 miles from the nearest military installation. In this situation, it may be more economical to collect samples at the destination. When submitting samples to the laboratory, you should follow the instructions supplied by the laboratory. (See Chapter 1 of this volume for general instructions on shipment of samples.) The correct number of DD Forms 1222, Request for and Results of Test, should accompany the shipment.

There are six PQA procedures or tasks that must be performed at destination in order to gather the information necessary to evaluate quality and contract compliance of dairy products. The frequency of examination will increase or decrease, depending upon the reliability of the contractor's quality control. Our discussion will reflect only the normal frequency.

(1) Once each month, you should examine each line item (each size container) for net weight. Normally, dairy products are weighed; however, you should occasionally perform volumetric examinations to check the accuracy of the tare weight used in your net weight examinations. Instructions for performing net weights of fresh dairy products are contained in HSC Bulletin 40-1, Subject Number 202, Net Weight Examination Report for Fresh Dairy Products. Health Services Command (HSC) Form 356 (fig. 1-16 and 1-17) is to be used for performing net weights of fresh dairy products.

(2) You should check the temperature of the shipment each delivery. Be sure to take temperatures throughout the load in accordance with Appendix A. Destructive sampling can be avoided by firmly placing the flat surfaces of 2 cartons together and sliding the thermometer between the cartons.

(3) Check the code date during the temperature examination and during off loading to assure that the shipment meets these requirements.

(4) The keeping quality examination is performed to determine whether or not the milk is off sufficient quality to stay fresh for the stated shelf life. This procedure is not routine in nature and should be performed based upon customer complaint. The product should be stored at a constant 40° F (4° C) preferably, or at 45° F (7° C). The product should be tested either 7 days after the date of pasteurization, if stored at 40° F (4° C), or 5 days after pasteurization, if stored at 45° F (7° C). The presence of winey or fruity flavors is the first indication of spoilage by psychrophilic organisms. Any irregular condition should be reported to the origin inspector.

(5) Organoleptic examinations are performed periodically during destination sampling, or based upon customer complaints. Any abnormal findings should be reported to the origin inspector for further investigation.

(6) Finally, you should maintain destination quality history records of your findings. These files are used to assist in determining a contractor's quality control reliability and in applying reduction in frequencies of examination.

Keep in mind that not only must you report all quality nonconformances in accordance with local policies and AF directives, but that you must also keep the origin inspector informed of all discrepancies noted at destination.

Exercises (623):

If one of the statements in exercises 1 to 7 about inspectors responsibilities is correct, mark it true (T); if it is false (F), correct it.

T F 1. The origin inspector arranges for routine selection and submission of samples for laboratory testing.

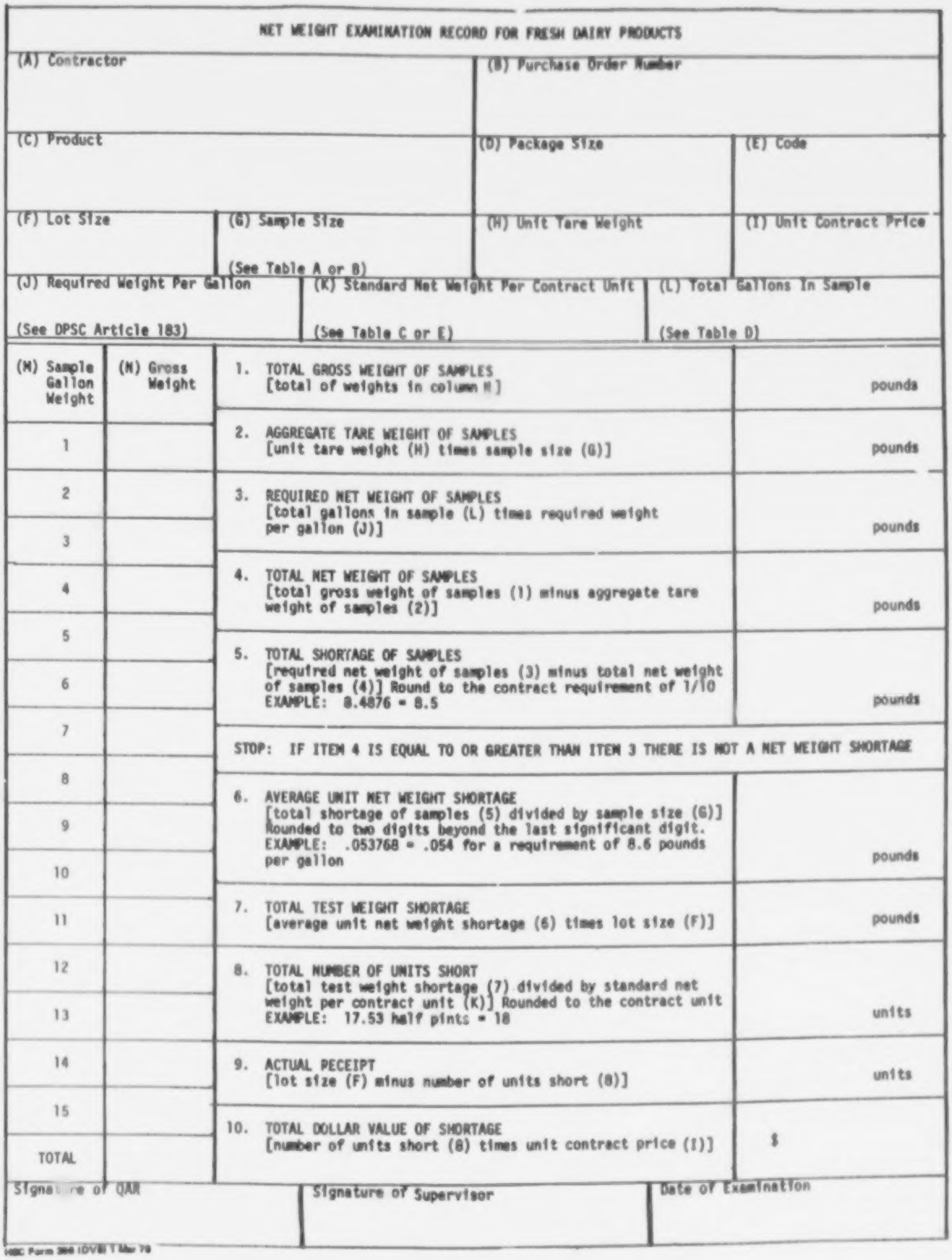
T F 2. The origin inspector coordinates all actions and test results on 2-out-of-4 nonconformances with the contractor, the subcontractor, CQAE, HQ HSC, and other agencies as warranted or directed.

T F 3. The origin inspector has the responsibility of initiating destination inspection procedures for each new contract.

T F 4. The keeping quality examination is performed on a routine basis by the destination inspector.

T F 5. Sampling or dairy products for submission to an Army medical laboratory is always done at destination.

T F 6. Net weights of fresh dairy products should be determined daily for each line item.



NET WEIGHT EXAMINATION RECORD FOR FRESH DAIRY PRODUCTS

(A) Contractor		(B) Purchase Order Number	
(C) Product		(D) Package Size	(E) Code
(F) Lot Size	(G) Sample Size (See Table A or B)	(H) Unit Tare Weight	(I) Unit Contract Price

(J) Required Weight Per Gallon (See DPSC Article 183)	(K) Standard Net Weight Per Contract Unit (See Table C or E)	(L) Total Gallons In Sample (See Table D)

(M) Sample Gallon Weight	(N) Gross Weight
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
TOTAL	

1. TOTAL GROSS WEIGHT OF SAMPLES [total of weights in column N]	pounds
2. AGGREGATE TARE WEIGHT OF SAMPLES [unit tare weight (H) times sample size (G)]	pounds
3. REQUIRED NET WEIGHT OF SAMPLES [total gallons in sample (L) times required weight per gallon (J)]	pounds
4. TOTAL NET WEIGHT OF SAMPLES [total gross weight of samples (1) minus aggregate tare weight of samples (2)]	pounds
5. TOTAL SHORTAGE OF SAMPLES [required net weight of samples (3) minus total net weight of samples (4)] Round to the contract requirement of 1/10 EXAMPLE: 8.4876 = 8.5	pounds
STOP: IF ITEM 4 IS EQUAL TO OR GREATER THAN ITEM 3 THERE IS NOT A NET WEIGHT SHORTAGE	
6. AVERAGE UNIT NET WEIGHT SHORTAGE [total shortage of samples (5) divided by sample size (G)] Rounded to two digits beyond the last significant digit. EXAMPLE: .053768 = .054 for a requirement of 8.6 pounds per gallon	pounds
7. TOTAL TEST WEIGHT SHORTAGE [average unit net weight shortage (6) times lot size (F)]	pounds
8. TOTAL NUMBER OF UNITS SHORT [total test weight shortage (7) divided by standard net weight per contract unit (K)] Rounded to the contract unit EXAMPLE: 17.53 half pints = 18	units
9. ACTUAL PECEIPT [lot size (F) minus number of units short (8)]	units
10. TOTAL DOLLAR VALUE OF SHORTAGE [number of units short (8) times unit contract price (I)]	$

Signature of QAR	Signature of Supervisor	Date of Examination

HSC Form 356 (DVB) 1 Mar 79

Figure 1-16 HSC Form 356.

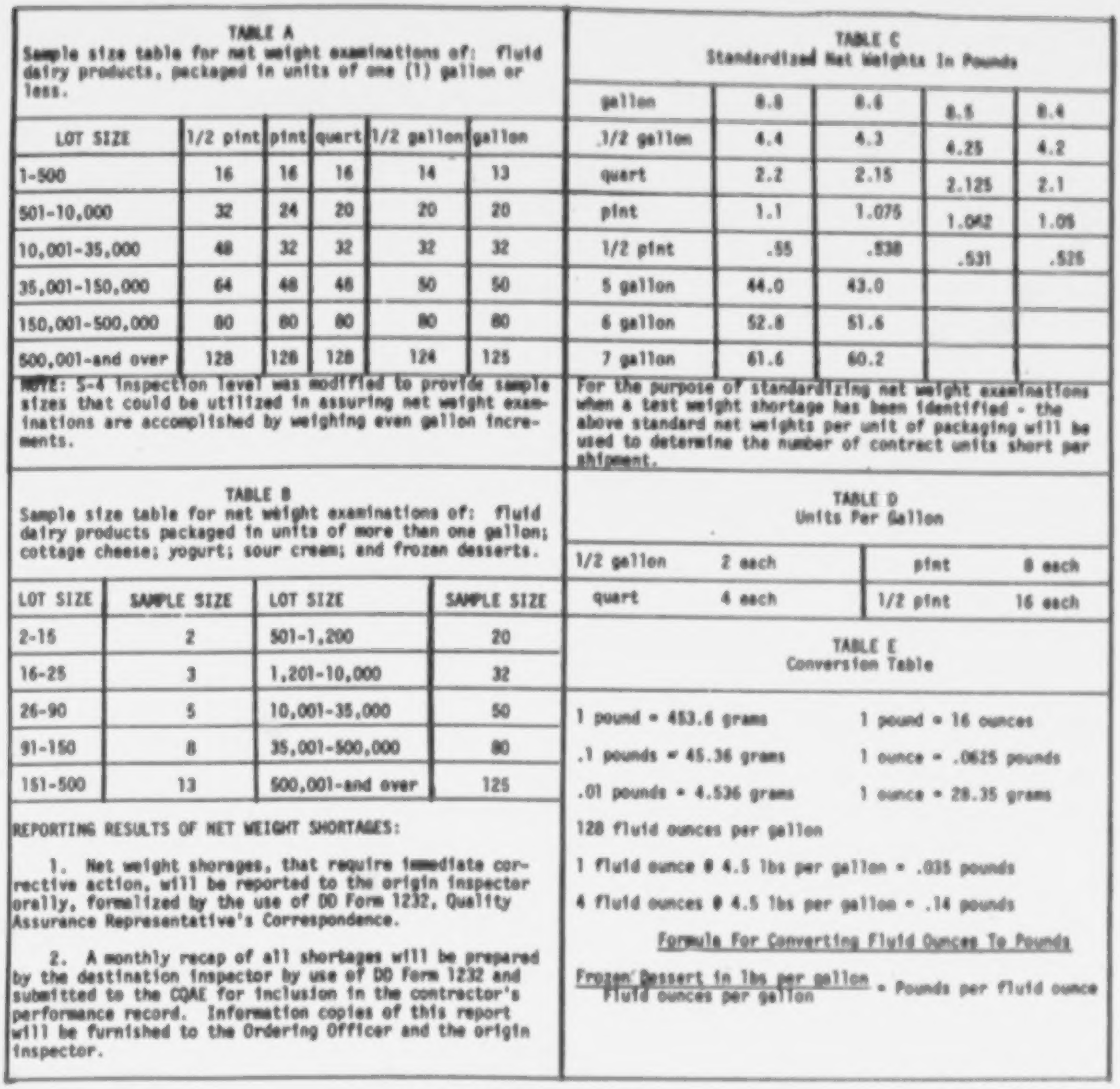


TABLE A
Sample size table for net weight examinations of: fluid dairy products, packaged in units of one (1) gallon or less.

LOT SIZE	1/2 pint	pint	quart	1/2 gallon	gallon
1-500	16	16	16	14	13
501-10,000	32	24	20	20	20
10,001-35,000	48	32	32	32	32
35,001-150,000	64	48	48	50	50
150,001-500,000	80	80	80	80	80
500,001-and over	128	128	128	124	125

NOTE: S-4 inspection level was modified to provide sample sizes that could be utilized in assuring net weight examinations are accomplished by weighing even gallon increments.

TABLE C
Standardized Net Weights In Pounds

gallon	8.8	8.6	8.5	8.4
1/2 gallon	4.4	4.3	4.25	4.2
quart	2.2	2.15	2.125	2.1
pint	1.1	1.075	1.062	1.05
1/2 pint	.55	.538	.531	.525
5 gallon	44.0	43.0		
6 gallon	52.8	51.6		
7 gallon	61.6	60.2		

For the purpose of standardizing net weight examinations when a test weight shortage has been identified - the above standard net weights per unit of packaging will be used to determine the number of contract units short per shipment.

TABLE B
Sample size table for net weight examinations of: fluid dairy products packaged in units of more than one gallon; cottage cheese; yogurt; sour cream; and frozen desserts.

LOT SIZE	SAMPLE SIZE	LOT SIZE	SAMPLE SIZE
2-15	2	501-1,200	20
16-25	3	1,201-10,000	32
26-90	5	10,001-35,000	50
91-150	8	35,001-500,000	80
151-500	13	500,001-and over	125

REPORTING RESULTS OF NET WEIGHT SHORTAGES:

1. Net weight shorages, that require immediate corrective action, will be reported to the origin inspector orally, formalized by the use of DD Form 1232, Quality Assurance Representative's Correspondence.

2. A monthly recap of all shortages will be prepared by the destination inspector by use of DD Form 1232 and submitted to the CQAE for inclusion in the contractor's performance record. Information copies of this report will be furnished to the Ordering Officer and the origin inspector.

TABLE D
Units Per Gallon

1/2 gallon	2 each	pint	8 each
quart	4 each	1/2 pint	16 each

TABLE E
Conversion Table

1 pound = 453.6 grams
.1 pounds = 45.36 grams
.01 pounds = 4.536 grams

1 pound = 16 ounces
1 ounce = .0625 pounds
1 ounce = 28.35 grams

128 fluid ounces per gallon

1 fluid ounce @ 4.5 lbs per gallon = .035 pounds

4 fluid ounces @ 4.5 lbs per gallon = .14 pounds

Formula For Converting Fluid Ounces To Pounds

$$\frac{\text{Frozen Dessert in lbs per gallon}}{\text{Fluid ounces per gallon}} = \text{Pounds per fluid ounce}$$

Figure 1-17 HSC Form 356 (Reverse).

T F 7. To avoid destructive sampling and to get a delivery temperature of the shipment, place surfaces of two cartons together and slide the thermometer between the cartons.

624. Given pertinent statements concerning contractor test results, provide the contractor's status and reporting procedure necessary.

Contractor Status and Frequency of Examination. Now that you are acquainted with the different areas of responsibility, let's look more specifically at the functional operation of the program. Contractors are encouraged to develop and maintain a degree of quality control (CQ) reliability which will allow the Government to reduce its PQA procedures to a minimum. When we test a contractor's products, we examine them at certain frequencies based on quality history for each type of product (i.e., fresh, whole milk, chocolate milk, 2 percent milk, etc.) and each produce characteristic (i.e., SPC, coliform, SNF, TS, etc.). Please remember that we consider each characteristic (conforming or nonconforming) separately for each type of product when determining contractor status.

The frequencies of examination are weekly, quarterly, and semiannually. We perform weekly examination on products of new contractors and on contractors whose QC reliability for that product is doubtful. Quarterly examinations are performed on a contractor's products having an acceptable degree of quality control reliability. To qualify for this frequency, three consecutive tests must show conforming results for all characteristics of the type of product involved and that not more than 1-out-of-4 consecutive test results for a characteristic fail to meet test requirements. Finally, the semiannual examinations are performed on a contractor's products which have demonstrated an excellent degree of quality control reliability. To qualify for this frequency, the products involved must have shown *no* test failures for a characteristic for four successive tests. These frequencies of examination are applied individually to each type of product. Thus, a contractor delivering three or more items may require utilization of all three frequencies of examination. You must understand that contractor status and frequency of examination are interrelated and based on laboratory test results.

The 1-out-of-4 test failure concept just mentioned is the minimum acceptable level of conformity. If test results indicate 2-out-of-4 nonconformances for the same characteristic for type of product, then you should increase sampling until the 1-out-of-4 level is reached or until the product is recommended for suspension due to 3-out-of-5 test result nonconformances. Remember that when reporting nonconforming results, we base our recommendation on the last 4, or when recommending suspension of a product, on the last 5 consecutive test results.

Reporting Nonconforming Results. Timely reporting of nonconformances and implementation of directed procedures is an important part of the dairy program. Never forget that your knowledge of Appendix A, the contract, and all pertinent contractually referenced documents is the key to the success of this program. When reporting a 1-out-of-4 nonconformance, you should simply orally advise the contractor. The 2-out-of-4 and 3-out-of-5 reporting procedures is somewhat more involved. Table 1-2 details these procedures. Figure 1-18 is a blank HSC Form 008 for reporting noncompliance of fresh or frozen dairy products.

In addition to having samples tested routinely, the Master Solicitation for Dairy Products and the DPSC 4155.6 *Subsistenced Inspection Manual (SIM)* outline procedures for reporting deficiencies of the weighted averages for whole milk, chocolate milk, and 2 percent milk. A minimum of two samples of each product must be tested during the month you would normally test that particular product. When reporting a deficiency of this nature, follow the instructions contained in Appendix A and the other publications already named.

The suspension period for any product which fails to meet the 3-out-of-5 concept is to be no less than 10 days. During this period the contractor must take action to correct the deficiency and submit a written request for reinstatement, certifying that corrective action has been accomplished. Upon written or oral approval of the contracting office to implement reinstatement procedures, you should submit samples for analysis. Reinstatement sampling continues until the minimum acceptable level of quality is met (1-out-of-4 nonconformances). If a contractor fails to meet the requirements, the contracting officer may terminate the entire contract without allowing additional time for correction.

Use tables 1-2 and 1-3, as necessary for the following exercises.

Exercises (624):

State (a) the contractor's status and/or (b) the reporting procedure necessary for each situation listed in exercises 1 to 5:

1. Test results for all products of a new contractor meet the minimum acceptable level of quality. That is, none exceeded the 1-out-of-4 failure concept. What (a) is the contractor status and (b) the reporting procedure which should be implemented?

2. You orally advise the contractor that two consecutive tests of fresh whole milk are nonconforming for SPC. What (a) is the present contractor status and (b) the next step in the reporting procedure?

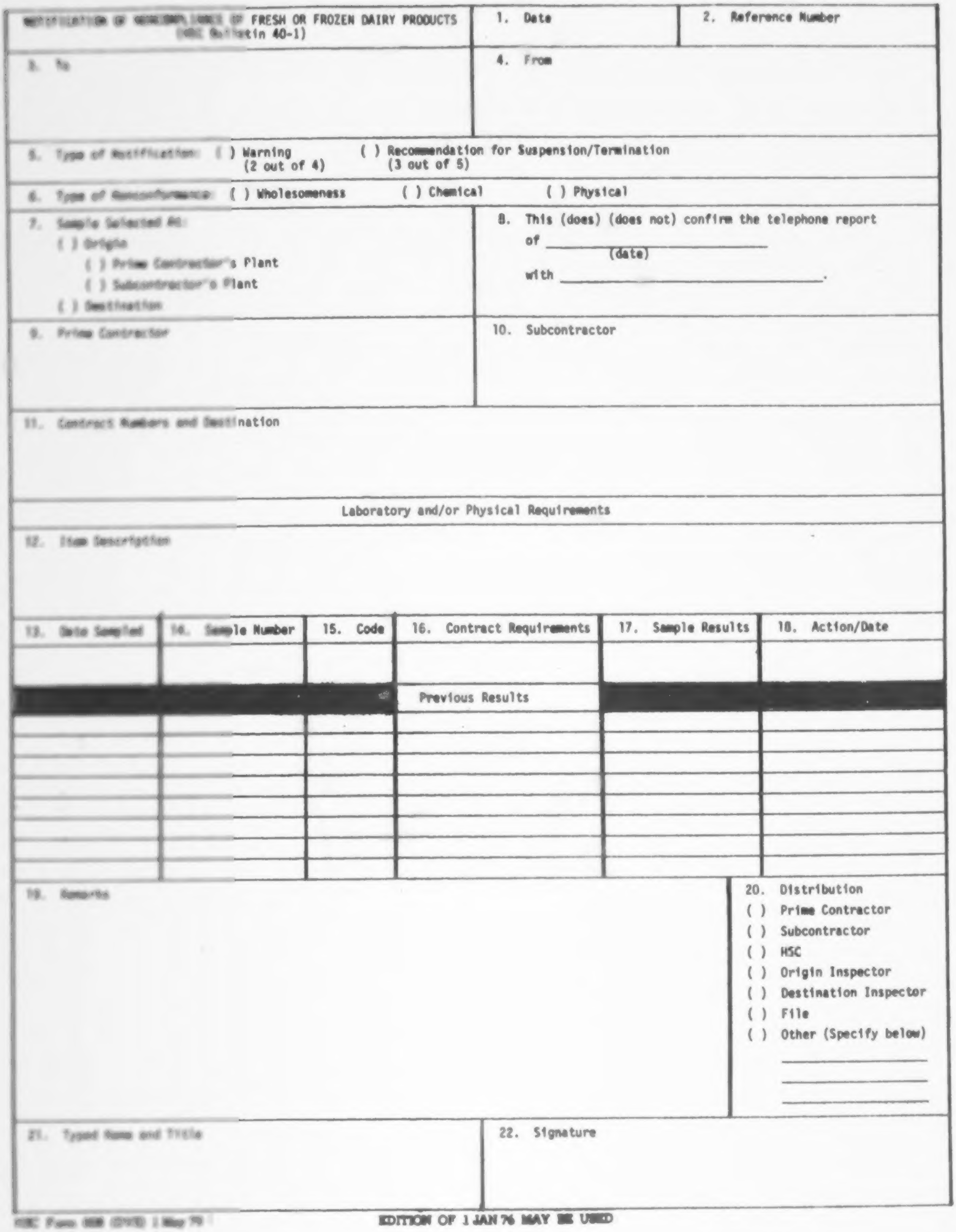
3. Test results for SPC on chocolate milk are nonconforming for three of the last five tests. What (a) is the contractor status for this product and (b) who, besides the contractor, and/or subcontractor, must receive a written report of our findings (table 1-2)?

4. Test results for skim milk show no test failure for the last four tests performed. What is the contractor status?

5. Table 1-3 reflects the conforming (C) and nonconforming (N) results or five consecutive laboratory tests performed on three different products being delivered to your installation. State (a) the contractor status and (b) the reporting procedure required for each product.

625. Given hypothetical laboratory tests, specify compliance/validity of the test results and what should be done in each situation.

Product Analysis Limits. The quality determinations for fats, total solids, volume, and net weight are, as you already know, designed to protect the financial interests of the Government. It may be less apparent, however, to consider the wholesomeness or health factors as also having monetary consideration. These financial interests are, of course, indirect and unlike the quality considerations, cannot be recouped by the Government. There is no practical or legal way of determining who reports to sick call due to the consumption of a *particular* unwholesome food product purchased under contract. Nor can we determine the man-hours lost due



NOTIFICATION OF NONCOMPLIANCE OF FRESH OR FROZEN DAIRY PRODUCTS
(HSC Bulletin 40-1)

1. Date

2. Reference Number

3. To

4. From

5. Type of Notification: ( ) Warning (2 out of 4) ( ) Recommendation for Suspension/Termination (3 out of 5)

6. Type of Nonconformance: ( ) Wholesomeness ( ) Chemical ( ) Physical

7. Sample Selected At:
( ) Origin
  ( ) Prime Contractor's Plant
  ( ) Subcontractor's Plant
( ) Destination

8. This (does) (does not) confirm the telephone report
of ____________________
(date)
with ______________________________.

9. Prime Contractor

10. Subcontractor

11. Contract Numbers and Destination

Laboratory and/or Physical Requirements

12. Item Description

13. Date Sampled	14. Sample Number	15. Code	16. Contract Requirements	17. Sample Results	18. Action/Date
			Previous Results		

19. Remarks

20. Distribution
( ) Prime Contractor
( ) Subcontractor
( ) HSC
( ) Origin Inspector
( ) Destination Inspector
( ) File
( ) Other (Specify below)
____
____
____

21. Typed Name and Title

22. Signature

HSC Form 008 [illegible] 1 May 79

EDITION OF 1 JAN 76 MAY BE USED

Figure 1-18 HSC Form 008.

TABLE 1-2

PROCEDURES TO FOLLOW WHEN NONCONFORMANCES ARE DETECTED

2-out-of-4 Test Failures	3-out-of-5 Test Failures
1. Immediately, orally advise contractor of test failure and that prompt corrective action is warranted.	1. Immediately, orally advise contractor that QC for the product(s) concerned has been determined unreliable and that a report with appropriate recommendations is being forwarded to the contracting officer & HSC Army Veterinarian
2. Confirm oral report to contractor with written warning notice (see fig. 2-1).	2. Confirm oral report to contractor with written recommendation for suspension/termination of product(s) (see fig. 2-1).
3. Provide information copies of warning letter to the Contracting Officer and the HSC Army Veterinarian.	3. a. Quality defects are orally reported to the contracting officer, confirmed by letter with copies of all pertinent contractor notification attached. Forward information copy to the HSC Army Veterinarian. b. Wholesomeness defects are orally reported to the HSC Army Veterinarian and confirmed with written report.
4. Increase rate of sampling for product involved. Submit sample(s) within 14 days but not before three days have elapsed from time of notification.	
Take any additional action requested by the Contracting Officer or the HSC Army Veterinarian.	

TABLE 1-3

CONFORMING AND NONCONFORMING RESULTS

Product	SPC					COLIFORM					BUTTER FAT				
	Result #					Result #					Result #				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
(1) Chocolate	C	C	N	C	N	C	C	C	C	C	C	N	C	N	C
(2) Skim	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
(3) 2%	N	C	N	C	N	C	C	C	C	C	C	C	C	C	C

to individuals not feeling up to par for some unknown reason. We can, as inspectors, reduce these *incalculable* variables by conscientiously applying the principles of food inspection and accurately interpreting the results of our examinations and tests. Since the results of tests performed on dairy products are usually "after consumption," the primary purpose of applying the principles of the dairy quality assurance program is to prevent a recurrence of the problem.

When you receive results of tests from the laboratory, *do not*—repeat—*do not* automatically assume they are accurate. Examine the paperwork carefully. Some things to consider before applying the results to a vendor's quality history file are:

a. What was the temperature of the product when it arrived at the laboratory? If the temperature was above 45° F (7° C) upon arrival, the results of wholesomeness examination are invalid.

b. How long was the product in transit? It is possible for a shipment to be delayed in transit, and we have no way of knowing how the product was handled during this delay. It is possible that, the product shelf life may have been exceeded when the product was tested.

c. Could the sampling procedures have had an effect on the results? Failure to adhere to the aseptic technique for pulling bulk samples can cause invalid results. Be certain, correct techniques were followed.

d. Was the product nomenclature (type, class, etc.) accurately annotated on the DD Form 1222 before shipment? This is normally checked prior to shipment, but it should be checked before applying results to a contractor's quality history record.

A contract is a legal and binding document. Therefore, as a representative of the Government, you have the legal responsibility to assure accurate and timely accomplishment of inspection procedures.

Table 1-4 is a list of product analysis limits for products frequently requiring laboratory testing. This table is provided to aid you in understanding better dairy product analysis limits associated with different classes of products. The wholesomeness limits for SPC and coliform are actually what determines the grade of milk. Products which exceed these limits are not classified "Grade A" milk products. The phosphatase activity test, which is not listed on the chart, must always be negative. A positive phosphatase activity test is grounds for immediate recommendation for suspension, regardless of contractor status. Likewise, after the origin inspector has determined that the problem has been corrected, immediate reinstatement is authorized. The reason for immediate suspension is that phosphatase activity indicates improper pasteurization temperatures were maintained and a potential health hazard exists.

After determining the accuracy of the results, you should post them to HSC Form 9 Quality History for Fresh Dairy Products, (fig. 1-19). You should then check for nonconformances, circle or underline them in red, and implement the procedures we have discussed in previous sections. If the results of tests are determined invalid, a new sample should be drawn and shipped to the lab.

Exercises (625):

Respond as necessary to the following situations and questions:

1. You receive laboratory results that indicate the SPC to be 20,000/ml; the coliform, 8/ml; the butterfat, 3.25 percent; the solids-not-fat, 8.29 percent; and the phosphatase to be positive. State whether these results are within required limits for milk, whole, fresh. If not in compliance, explain why not.

2. The bacterial results of a bulk milk sample are nonconforming; however, when you explain the procedures for positing the results to the airman who took the sample, the individual comments that he or she mistakenly let the product sit out at room temperature for almost 3 hours. Are the results of the test valid or invalid for this product? If they are invalid, explain why and what actions should be taken.

3. Results of tests received indicate the coliform content of chocolate ice cream to bed 18 calories/gm. Is this product conforming or nonconforming to specification requirements?

4. Results of tests on chocolate milk for SPC is reported as "TNTC" (too numerous to count). Further review of the report reveals that the product was received at a temperature of 50° F. Are the results valid? If so, what action, if any, should be taken?

626. Determine the validity of stated situations/statements concerning the dairy plant inspection program.

Exempt Status. Dairy processing establishments that are inspected by the State milk sanitation rating officer and that receive a sanitary compliance rating (SCR) of 90 or more are eligible to sell to the military. The military veterinary service need not sanitarily inspect an establishment meeting this requirement; however, before the award of contracts, we must verify the status of a contractor. We can verify a contractor's status by checking two publications distributed by USDA and USPHS.

The Interstate Milk Shippers List (IMS), as it is known, has the official title of *"Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers."* It is published by the USPHS. This publication lists, by state, those dairies having an SCR of 90 or more and also lists the *general category* of products the plant is approved to manufacture. The inspections are conducted by the State milk sanitation rating officer in accordance with either the *Grade "A" Pasteurized Milk*

TABLE 1-4
DAIRY LABORATORY TEST ANALYSIS RESULTS

	SPC Col/ml	Coliform Col/ml	% Milk Fat (min)	% Solids Not Fat (min)	%Total Solids
Milk Whole Fresh	20,000	10	3.25	8.25	--
Coffee Cream	"	"	18.00	--	--
½ & ½ Cream	"	"	10.50	--	18.00
Skim Milk (plain)	"	"	0.50(max)	8.25	--
Skim Milk 4/	"	"	0.50(max)	10.00	--
Low Fat Milk (Plain)	"	"	0.50 to 2.00(max)	8.25	--
Low Fat Milk 4/	"	"	"	10.00	
2% Milk (plain)	"	"	1.90 to 2.10(max)	8.25	--
2% Milk 4/	"	"	"	10.00%	--
Chocolate Milk (plain)	"	"	3.25	8.25	--
Chocolate Milk 4/	"	"	"	10.00	--
Chocolate lowfat milk or drink(plain)	"	"	0.50 to 2.00(max)	8.25	--
Chocolate lowfat milk or drink 4/	"	"	"	10.00	--
Chocolate skim milk or drink (plain)	"	"	0.50(max)	8.25	--
Chocolate skim milk or drink 4/	"	"	0.50(max)	10.00	--
	Col/gm	Col/gm			
Ice Cream Vanilla (Grade 1)	50,000	10	10.00	10.00	--
Ice Cream Vanilla (Grade 2)	"	.10	14.00	10.50	--
Ice Cream Chocolate & other flavors					
(Grade 1)	"	20	8.00	8.00	--
" " " (Grade 2)	"	20	12.00	10.50	--
Novelties	50,000	20	Depends on class ordered		
Vanilla Ice Milk mix 2/	"	10	4.00	12.5	
Chocolate " " " 2/	"	20	3/ 3.50	12.00	
Vanilla Milk Shake mix 2/	"	10	4.00	13.00	
Chocolate Milk Shake mix 2/	"	20	3/ 3.50	12.00	

1/ This table is for instructional purposes only. Do not use as requirements for current contracts.

2/ May contain milk fat or vegetable fat.

3/ This percentage is exclusive of fat from chocolate or cocoa flavoring. Total fat shall have a minimum of 4.00%.

4/ Nonfat milk solids added.

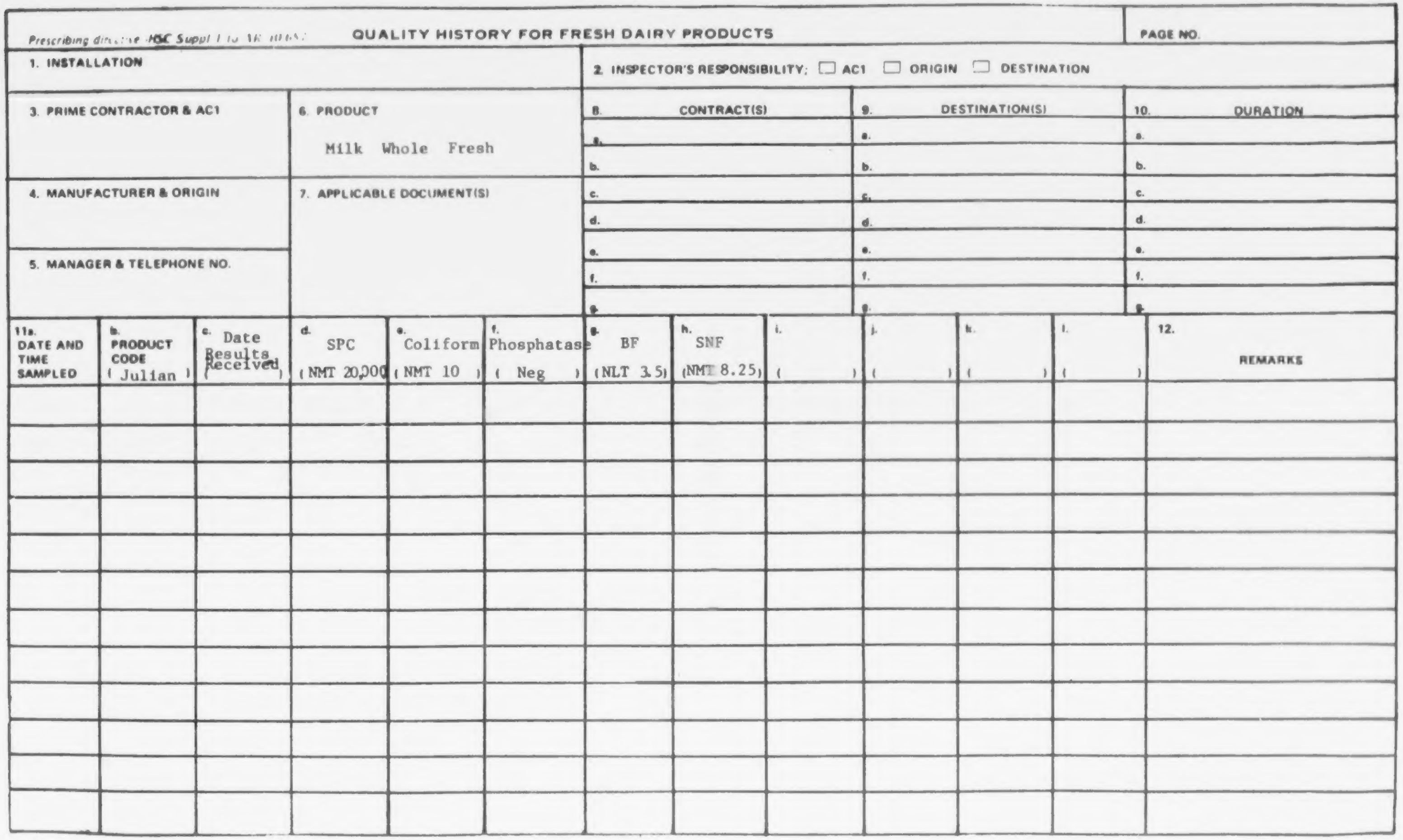
Ordinance or the Methods of Making Sanitation Ratings of Milk Sheds.

Dairy plants surveyed and approved for USDA grading service lists, by state, the *specific* products a particular dairy plant is sanitarily approved to manufacture. These inspections are conducted in accordance with Title 7, Chapter J, Part 58 of the Code of Federal Regulations.

Dairy plants listed in either the IMS or the USDA publication are exempt from military veterinary sanitary inspections and are further exempt from listing in a military sanitarily approved food establishment publication.

Nonexempt Status. Dairy plants not listed in the USDA or USPHS publications and all dairy plants manufacturing ice cream and frozen dessert products are not exempt from military sanitary inspection and must be approved and listed in one of three publications.

The Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement (the "Directory") is another publication you will refer to. A contractor in a nonexempt status and wishing to sell products to more than one military installation must be listed in the "Directory." The contractor must make



Prescribing directive HSC Suppl 1 to AR [illegible]

QUALITY HISTORY FOR FRESH DAIRY PRODUCTS

PAGE NO.

1. INSTALLATION

2. INSPECTOR'S RESPONSIBILITY: ☐ AC1 ☐ ORIGIN ☐ DESTINATION

3. PRIME CONTRACTOR & AC1

4. MANUFACTURER & ORIGIN

5. MANAGER & TELEPHONE NO.

6. PRODUCT Milk Whole Fresh

7. APPLICABLE DOCUMENT(S)

8. CONTRACT(S)	9. DESTINATION(S)	10. DURATION
a.	a.	a.
b.	b.	b.
c.	c.	c.
d.	d.	d.
e.	e.	e.
f.	f.	f.
g.	g.	g.

11a. DATE AND TIME SAMPLED	b. PRODUCT CODE (Julian)	c. Date Results Received ( )	d. SPC (NMT 20,000)	e. Coliform (NMT 10)	f. Phosphatase (Neg)	g. BF (NLT 3.5)	h. SNF (NMT 8.25)	i. ( )	j. ( )	k. ( )	l. ( )	12. REMARKS

HSC Form 9 (DVS)
1 Jan 78

Figure 1-19 HSC Form 9.

a written request to the procurement officer of each military installation that officer wishes to service. The procurement officer will then forward DD Form 1231, Request for Veterinary Corps Sanitary Inspection of Establishment, to the Commander of the Health Services. Command (HSC), Fort Sam Houston TX 78234; or, in oversea areas, to the major oversea command surgeon (Army, Navy, or Air Force). The HSC commander or major command surgeon will then request the military veterinary officer nearest the requesting establishment to conduct the initial inspection and any required followup inspection. Upon approval, the establishment will be listed in the "Directory," and the contractor may bid any contracts requiring the products that particular contractor manufactures. *MIL-STD-668, "Minimum Sanitary Standards for Food Plants,"* authorizes the basic procedures for conducting inspection of fresh dairy product plants. MIL-STD-1155, *"Sanitary Standards for Frozen Dessert Plants,"* outlines the procedures for conducting inspection of ice cream and frozen dessert manufacturing establishments. A contractor wishing to bid on contracts at only one military installation and who is in a nonexempt status must request approval of the local base commander. The veterinary officer of Environmental Health Officer conducts the inspection, using the same military standards just mentioned.

Once a plant is sanitarily approved, the contractor's name appears on the "Local Approved List" and the contractor may bid on contracts at that particular installation only.

Exercises (626):

If one of the statements in exercises 1 to 4 on the plant dairy inspection program is correct, mark it true (T); if it is false (F), correct it:

T F 1. A vendor delivering to Broadman AFS TX and Fort Glenn Army Post TX and not being inspected by the state would have to be sanitarily approved by the military and appear in the local approved list.

T F 2. A dairy plant that processes frozen desserts must have the dessert processing and storage facilities inspected and approved by the nearest military veterinary or environmental health office before it can deliver to a military installation.

T F 3. A dairy plant with a sanitary compliance rating of 89 and only one critical defect would be listed in the interstate milk shippers list.

T F 4. Military Standard 669 outlines the basic procedures for conducting inspection of dairy processing facilities.

1-8. Eggs and Egg Products

Pound for pound, eggs are surpassed only by milk as the most abundantly used food in the United States. Eggs are an excellent food for body maintenance. The only known vitamin for which eggs are a poor source is vitamin C.

In the inspection of this highly perishable product, we must be efficient and assure the purchase of high-quality eggs, and after purchase, their proper handling and storage. Our responsibilities in this area are primarily at destination. We are also required, however, to perform surveillance inspections and to occasionally act in an advisory capacity on local procurement. For these reasons, we devote this chapter to these procedures, along with related data, and add a short discussion on frozen and dehydrated eggs.

Shell egg inspection for military procurement includes grading or handling a percentage of a lot of individual eggs and the factors to consider when determining quality. You must also learn the grading systems, weight classes, and finally, the administrative procedures for recording results of your inspections.

627. Arrange a list of the quality grades for eggs from highest quality to lowest quality.

Quality Grades for Eggs. The quality determination, as used here, refers to the quality of individual eggs. Remember, no egg may grade any higher than its lowest quality factor. For example, an egg that, which is considered to be of A quality in all factors but is leaking, can grade no higher than "leaker." The quality of an egg determines its grade, and the quality factors we consider in determining the grade are shell, air cell, white, and yolk. By digesting the knowledge about eggs as it is developed in this text, you will find egg inspection much easier to understand. The individual egg grades, listed in their order or acceptability, from the highest grade to the lowest, are:

AA
A
B
Dirty
Check
Leakers
Loss

Exercises (627):

The list of egg qualities (column B) is jumbled. Rearrange this list in column A in the proper order of acceptability:

Column A	*Colum B*
___(1)	AA.
___(2)	Loss.
___(3)	Check.
___(4)	Dirty.
___(5)	Leaker.
___(6)	B.
___(7)	A.

628. Specify how to determine the net weight of a case of eggs and, given weights for individual cases, the correct size category for each individual case.

Weight Classes. The weight classes for consumer grades are shown in table 1-5. If you study them carefully, you will find that they are self-explanatory. Do not think that, because we are not discussing them extensively, weight is not important. In fact, quite the opposite is true. Eggs that do not meet the weight requirements for their grade should be reported to the proper authority with an appropriate recommendation. Weight is not considered a quality factor in egg inspection. For example, a particular egg may be underweight and still be an A quality egg.

Now that you have studied the table on weight requirements, we are going to consider the procedures for determining these weights. There are two basic methods for doing this.

The *first* method is to weigh all fillers and flats, including the eggs (15 dozen) from one end of a sample case, and to record the weight to the *lowest* ¼ pound. This number, expressed as a decimal, is multiplied by 2. A tare weight of 3½ pounds is subtracted for each 30-dozen egg case with six flats and five 36-egg fillers on each side. For a 30-dozen egg case with six 30-egg filler-flats on each side, subtract 2 pounds for tare weight. If the cases do not have the number of flats and fillers we have described, establish the tare weight by weighing at least 20 sets of flats and fillers or 20 filler-flats.

The *second* method is to weigh a case of eggs, complete with packing material (flats and fillers); this is the *gross weight*. Next, remove all of the eggs from two cases, weigh the cases and packing material, and divide by 2. This is the *average tare weight*. Now subtract the tare weight from the gross weight to arrive at the net weight. Let's look at an example:

Gross weight of one case = 51.00 pounds
Tare weight of case No. 1 = 4.00 pounds
Tare weight of case No. 2 = 5.00 pounds
Average tare weight = $\frac{4 + 5}{2}$ = 4.50 pounds
Net weight = 51.00 − 4.50 = 46.50 pounds

This second method should be employed only when you cannot accurately determine net weight by the first method.

Exercises (628):

1. You are checking the weight of a case of eggs containing 30 dozen eggs. There are twelve flats and ten 36-egg fillers in the case. You arrive at a net weight of 45 pounds. (a) What is the gross weight of the case, and (b) how did you arrive at the net weight of 45 pounds?

2. Using table 1-5, answer exercise 2.

The following are individual case net weights for consumer grade eggs. Classify each case as to its proper weight class.

Case Weights	*Weight Class*
a. 46.0 lbs.	________
b. 50.5 lbs.	________
c. 45.0 lbs.	________
d. 58.5 lbs.	________
e. 32.0 lbs.	________
f. 33.5 lbs.	________
g. 34.5 lbs.	________
h. 48.0 lbs.	________

629. Determine the validity of selected situations/statements concerning miscellaneous requirements for shell egg inspection.

Miscellaneous Requirements for Shell Egg Inspection. In addition to weight and other requirements previously mentioned, consider the following when you inspect shell eggs.

Verification inspection of shell eggs DPSC Manual 4155.6, DPSC Subsistence Inspection Manual, Sub. Sec. 222.1. Verification Inspection of Shell Eggs. Acceptance inspection of shell eggs at destination will be for identity, count, and condition. In addition, verification of origin grade and all other terms of contract should be performed. Shell eggs not accompanied by the required USDA grade or Certificate of Conformance (COC) should be ejected and the incident reported to the ordering officer. You should also consult DPSC Article 137, "Defense Personnel Support Center Particular Requirements for Shell Eggs, C-E-271," for required certificates. There is an exception to these inspection certificates. When specified in the purchase documents, the USDA grade shield on each individual resale carton (dozen) is acceptable in lieu of a USDA grade certificate.

Origin verification inspection will be accomplished only when specified by the procuring contracting officer (PCO) and then only after grading has been accomplished by the USDA.

Serviceability categorization criteria. The serviceability categorization tables contain the same information as the tables in DPSC Manual 4155.6. Subsection 222.1. Their purpose is to aid the ordering officer. When shell eggs which are delivered on requirements-type contracts containing DPSC Clause G-12 (i.e., delegation of contract administrative authority to the ordering officer) are found to be nonconforming, the quality assurance representative (QAR) should expeditiously report the findings to the ordering officer. If the ordering officer, at the contractor's request, is considering granting a waiver to the requirements for which the eggs are

TABLE 1-5

US WEIGHT CLASSES FOR CONSUMER GRADES FOR SHELL EGGS

Size or Weight Class	Minimum Net Weight Per Dozen	Minimum Net Weight Per 30 Dozen	Minimum Weight for Individual Eggs at Rate per Dozen
	Ounces	Pounds	Ounces
Jumbo	30	56	29
Extra Large	27	50-1/2	26
Large...........	24	45	23
Medium	21	39-1/2	20
Small	18	34	17
Peewee	15	28	....

A lot average tolerance of 3.3 percent for individual eggs in the next lower weight class is permitted as long as no individual case within the lot exceeds 5 percent.

nonconforming on the basis of an equitable price adjustment, the destination QAR must categorize the nonconformance as critical, major, or minor in accordance with the serviceability criteria.

For the requirements-type contracts that do not contain DPSC Clause G-12 and carlot contracts for delivery to supply points or direct vendor delivery overseas, nonconformances must be reported to the appropriate contract quality assurance element (CQAE) for action by the PCO.

On requirements-type contracts and at the request of the ordering officer, the destination QAR should evaluate the effect of nonconformances on the overall serviceability of the eggs. This evaluation will assist the ordering officer in granting or denying a request for waiver and in establishing an equitable price adjustment when appropriate. When reporting inspection findings which exceed the tolerance established for a combination of factors, the QAR should report the total combined percentages and the percentages for each individual factor (e.g., total, 0.80%; dirties, 0.30%; leakers, 0.25%; loss 0.25%).

When the QAR rejection is based upon a determination that supplies are unwholesome, the effect on serviceability must be categorized as "critical." When available, a military Veterinary Corps officer should confirm the QAR's finding of unwholesomeness. Ordering officers are not permitted to grant a waiver for supplies placed in the "critical" category.

Nonconformance to weight classes is reported to the CQAE for referral to the PCO.

One very important thing to remember is that the serviceability categorization criteria is for the use of destination military inspectors and contract administration personnel and must not be released to suppliers or contractors.

Formal review. Formal review (appeal grading), when authorized by the PCO, shall only be performed by the USDA for destination grade nonconformances on lots for which USDA performed inspection at origin. Provisions governing formal review by USDA and reinspections by a military inspector are set forth in DPSC Article 137. Formal reviews or reinspections are performed at the request of the PCO, and the results are reported by the QAR to the CQAE.

Brand name procurement. You should inspect shell eggs purchased by "brand name" at destination for identity, condition, and count and any special requirements of the purchase documents.

When specified in the contract, the contractor may perform grading at origin for lots of 200 cases (6,000 dozen) or less in lieu of USDA's grading. In these instances, the contractor should utilize the regulations governing the Grading of Shell Eggs and United States Standards, Grades and Weight Classes for Shell Eggs and provide a contractor's certificate of conformance to accompany the shipment. The destination QAR must inspect for all terms of the contract, including identity, count, and condition, verification of grade and weight class, etc. Lots found to be nonconforming by the QAR are not eligible for formal review by the USDA if received on a COC, but they are subject to reinspection by a military QAR upon request by the contractor for a valid technical reason and approved by the contracting officer.

Use of inspection documents. We have already listed some of the official documents pertaining to shell egg inspection. One thing to remember about the proper use of documents is that we inspect for identity, count, and condition. The different classes of inspections and the amount of purchase have a significant bearing on the documents used in accomplishing your inspection.

Appropriated fund procurement. The commissary purchases two types of eggs on two kinds of procurement instruments. These are (1) requirement-type contracts and (2) local purchase/blanket purchase agreements (BPAs), discussed next. In addition, several other aspects of appropriated fund procurement are taken up thereafter.

Requirement-type contract. DPSC procures consumer grade eggs for resale and troop issue on requirements-type contracts.

Local purchase/blanket purchase agreement (BPA). This type of purchase is for eggs in the local area. Usually on this type of purchase no inspection will have been accomplished, so destination inspection should consist of all terms of the contract, including, but not limited to, identity, count, and condition. One very important thing to remember about local purchase is that your base should review this type of contract to insure that inspection criteria and inspection documents are referenced in the contract. Two preeminent documents that should be referenced as inspection documents are (1) the U.S. Standard for Eggs and/or (2) the Federal Specification.

Origin inspection reports. The Defense Personnel Support Center (DPSC) requires that a United States Department of Agriculture (USDA) Egg Grading Certificate accompany a shipment of 6,000 dozen eggs or more. For shipment of less than 6,000 dozen, a contractor grading certificate will suffice, if this is permitted by the purchasing instrument. Eggs should not be accepted at destination in the absence of the applicable certificate.

Transit temperatures. The average internal temperature of eggs, on a lot basis, must not exceed 60° F (16° C) upon arrival at their destination. On contracts of 400 cases or more, the eggs must be loaded into a vehicle precooled to no higher than 50° F (10° C). This means that the carrier temperature is of no concern to us on shipments of less than 400 cases. But let us emphasize here that, regardless of the size of shipment we receive, the internal *average* temperature of the eggs (on a lot basis) must be no higher than 60° F (16° C). The only allowance is that individual cases may have an egg internal temperature of 65° F (18° C) *provided* the average temperature for the shipment is not more than 60° F (16° C). On the other extreme, we certainly would not accept eggs if they were, or had been, frozen.

Damage in transit. You should be on the alert for transit damage from the time the door of the vehicle is opened until the eggs are off-loaded. If you note any damage, arrange a joint inspection with the carrier's representative within 24 hours. Notify DPSC and the base traffic management officer immediately.

Packing and marking requirements. The purchasing instrument and related documents are our basic authority here. All marking requirements on the cases and cartons must be as specified in these documents. Check them carefully, and you will probably find that they refer either to *Packing Level B* or to *Packing Level C.*

a. Packing Level B. This is normally used on domestic procurement of eggs for oversea shipment. Additional packing material has been added to the product to afford better protection against damage. This type of pack is commonly called *export pack.*

b. Packing Level C. This is often referred to as *domestic pack.* Practically all eggs procured for domestic use are in this type of pack. Normally, there is no additional packing material included, except as required by the purchasing instrument or related documents.

Variation in quantity. A 2-percent variation in quantity is authorized for contract quantities of *less* than 9,000 dozen eggs. For contract quantities of 9,000 dozen or more, you can accept them with up to a 5-percent quantity variation.

Sample size and selection. Sample size and selection is the same at origin and destination. However, when you inspect, make certain the eggs being offered are properly identified and separated into specific lots by the contractor before you start your inspection. If you are inspecting eggs of mixed grades and sizes, each grade and size should be considered as a totally separate lot. Now let's see how large your samples should be.

The size of samples naturally depends upon the size of the lot or number of cases in the shipment. Whenever grading is performed on a representative sample basis, the sample should be drawn and consist of not less than the minimum number of cases, as indicated in the following table. A minimum of one hundred eggs should be examined per sample case. For lots consisting of less than one case, a minimum of 50 eggs should be examined. If the lot consists of less than 50 eggs, all eggs should be examined.

No. of Cases in Lot	*No. of Sample Cases*
1	1
2-10	2
11-25	3
26-50	4
51-100	5
101-200	8
201-300	11
301-400	13
401-500	14
501-600	16

For each additional 50 cases, or fraction thereof, in excess of 600 cases, one additional case should be included in the sample. You know by now that we inspect 100 eggs from each sample case, and that you should practice representative sampling in selecting these individual eggs.

Exercises (629):

Indicate which following statements about requirements for egg shell inspection are true (T) and which are false (F). Supply the necessary information to correct any false statements:

T F 1. On a lot basis, the average internal temperature of eggs must not exceed 50° F upon arrival at destination.

T F 2. A USDA Egg Grading Certificate must accompany a shipment of 6,000 or more dozen eggs.

T F 3. When inspecting eggs of mixed grades and sizes, you may combine the lot provided you have the correct number of sample cases.

T F 4. The number of sample cases to be inspected in a lot containing 42 cases is 5 sample cases.

T F 5. In transporting eggs, the carrier temperature is of no concern if the shipment contains less than 400 cases.

T F 6. A 4-percent variation in quantity is authorized for contract quantities of less than 9,000 eggs.

630. Resolve the validity of given requirements regarding nonappropriated fund procurements.

Nonappropriated Fund Procurement. This area has two types of procurement: the Morale, Welfare and Recreation (MWR) activities and the Army and Air Force Exchange Service (AAFES) activities.

The MWR contracts may either purchase brand name eggs "equivalent to or better than" a specified grade and not list any applicable documents, or they may specify USDA regulations and Federal specifications. AAFES purchases eggs in accordance with Exchange Service Manual (ESM) 25-1, *Food and Supplies*.

At this point we have covered the determination of individual egg quality, lot grades, weight, and other considerations in shell egg inspection. Our next consideration is keeping a record of this information when we make an inspection. DD Form 1237, Report of Inspection of Shell Eggs, is available for this purpose.

Exercises (630):

Indicate which of the following statements about nonappropriated fund procurements are true (T) and which are false (F). Correct those statements you find to be false.

T F 1. AAFES facilities purchase eggs in accordance with the Master Solicitation and Federal Specification 271J.

T F 2. Standards for egg procurement by nonappropriated fund facilities such as the NCO club and airmen's club require purchase in accordance with ESM 25-1.

631. State temperature and humidity requirements relative to the duration of storage for fresh shell eggs.

Storage Temperature and Humidity Requirements for Eggs. Two general statements should be made at the outset of our discussion on egg preservation and storage; they are: (1) handle storage eggs as little as possible, and (2) eggs for storage should be of the highest possible quality. The reason for both is that under ideal conditions, quality can change only in one direction—down. The major disadvantages of storage eggs are the possibility of off-flavors and off-odors as well as the increase in the quantity of thin whites. Generally speaking, these result in poorer cooking qualities. To combat these disadvantages and prolong their storage life, eggs are subjected to a processing which seals the pores of the shell, preventing the loss of carbon dioxide and water, the absorption of off-orders and off-flavors, and the entrance of bacteria. Two of the most accepted methods of accomplishing this sealing are by *oil processing* and *heat treatment*. We will discuss both later.

The maximum storage time of processed eggs, whether they are thermostabilized or oil-treated, is considered to be 4 months for export and 7 months for domestic, provided they are maintained at the proper temperature (29° F to 31° F) (−2 to −1° C) and humidity (85 to 90 percent). While we are on the subject of storage, let's consider the generally accepted storage temperature and humidities for shell eggs in greater detail.

Refrigeration is the most common and most desirable method for storing eggs, with the temperature, humidity, and ventilation carefully controlled.

For prolonged storage, the temperature should be maintained at from 29° F to 31° F (−2 to −1° C). For short-time storage (1 to 14 days), they may be held at no higher than 50° F (10° C). Three important factors to consider in relation to these temperatures are (1) eggs freeze at 28° F (−2° C), (2) eggs start to deteriorate at 32° F (0° C), and (3) eggs taken from a cold room to a warm room will sweat and decline rapidly in quality.

Now a word about humidity and ventilation. Because mold growth proceeds rapidly at humidities above 88 percent, it is very important to keep the temperature as low as possible without freezing. Ventilation also controls mold growth and eliminates foreign odors which can be absorbed through the shell.

Exercises (631):

1. At what temperature (Fahrenheit/Centigrade) do fresh shell eggs begin to deteriorate?

2. Fresh shell eggs expected to be in storage for more than 4 months should be stored at temperatures between what degrees (Fahrenheit/Centigrade)?

3. In terms of percent, what is the optimum relative humidity for the storing of fresh shell eggs?

632. Cite the appropriate publications in which egg producers or processors must be listed in order to sell Armed Forces establishments and indicate the office where a processor is sanitarily inspected and approved.

Approved Sources. In order for egg processors to sell to the Government, they must be sanitarily approved by either a civil or military agency. After meeting the sanitary requirements, which we will discuss briefly in the next section, the processor is listed in one of these publications:

- *List of Plants Operating under USDA Poultry and Egg Grading and Egg Products Inspection Program.*
- *Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement (HSC "Directory").*
- *The Local Approved List.*

A plant sanitarily approved and listed in the USDA publication need not be inspected by the military. The processors listed by Health Services Command (HSC) usually service more than one military installation and are not routinely inspected by the USDA. The closest military inspection office normally has the responsibility for the HSC directory inspections. Locally approved establishments sell only to the base which inspects them, and the list is published and approved by the local commander.

Exercises (632):

1. An egg processing facility selling egg products to several different military bases and not appearing in the USDA publication must appear in what other publications?

2. A processor listed in the HSC directory is sanitarily approved and inspected by what office?

3. Processors whose names appear in what publication need not be inspected by the military?

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CHAPTER 2

Food Technology fcr Nonanimal Origin Subsistence

AS A FOOD inspector, the environmental medicine specialist has to keep in close touch with the latest developments in food technology, as well as the current product specifications and contract requirements.

As an identifier of unwholesome product and contract noncompliance, the inspector must be able to explain normal product characteristics and to determine when exhibited product characteristics do not meet that norm. We have already spent much time discussing the characteristics of wholesome and contractually sound animal origin subsistence. These sources of food are the easiest to learn as regards the ways in which each may become defective, unsafe, or unappealing to the consumer.

We will now discuss a more difficult area of concern for the food inspector—the inspection of nonanimal origin subsistence. These foods are difficult to inspect for several reasons: (1) They are slow to spoil; (2) they may be unfit for use long before they are identified as such; and (3) they can carry and transmit disease organisms; yet (4) they exhibit the superficial quality characteristics we all apply to foods of this type.

It is hard to grasp the knowledge we offer in this section. We therefore recommend you take your time in this section and learn the reasons behind the quality standards that are applied to these nonanimal origin foods by the military procurement agencies.

2-1. Fresh Fruits and Vegetables

NUTRITIONALLY speaking, the fresh fruits and vegetables purchased by the Armed Forces are quite a bargain: an investment in good health. The reason is that each day these foods supply high percentages of the body's nutritional requirements: protein, 13 percent; carbohydrates, 15 percent; minerals, 52 percent; vitamin A, 58 percent; vitamin B, 48 percent; and vitamin C, 92 percent. The quality and freshness of these products, as well as the techniques used in their handling, directly affect the nutrient content. Part of your job will be to determine whether the fresh fruits and vegetables delivered to your base are fresh, of good quality and condition, and are being handled in the proper manner.

Your responsibilities concerning fruit and vegetable inspection will vary, depending on the base to which you are assigned. Rest assured, though, that all bases have some fruit and vegetable inspection requirements. We will cover many aspects of fresh fruit and vegetable inspection in this chapter, including the methods used by the Government to purchase produce, the inspection criteria and steps used in performing the various classes of fruit and vegetable inspections, the factors that influence the storage life of fruits and vegetables, the grades of produce, and some condition factors peculiar to the major fruits and vegetables purchased by the Government.

Before you can completely understand the principles of proper fruit and vegetable storage or the criteria for their inspection, you need some knowledge of the physiology of plants. Therefore, we will begin this chapter with a discussion of the physiological processes of the plants and plant parts that we call fruits and vegetables.

In this section, we will look at several life processes characteristic of plants and plant parts (fruits and vegetables) in order to understand the changes they undergo, the requirements for their proper storage, and the observable criteria on which their inspection is based. We will discuss photosynthesis, transpiration, respiration, maturity, and ripeness.

633. Given statements concerning various physiological processes of fruits and vegetables, identify by name the process for each.

Photosynthesis. *Photosynthesis* is the means by which plants, with the use of sunlight, manufacture certain essential chemical compounds. Chlorophyll, a pigment in the green parts of plants, traps sunlight and uses the solar energy for combining water, absorbed by the roots, and carbon dioxide from the air to produce a simple sugar and oxygen, which is given off as a gas. Most of the sugar is converted into starch (carbohydrate) which is then stored for use as food for the plant. Transport tissues carry much of the sugars and carbohydrates to various storage positions within the plant; for example, the tubers of potatoes and the edible tissues of fruits, such as apples or pears.

Transpiration. *Transpiration* is the process by which excess water, which was absorbed through the roots, is given off through pores (stomata) in the leaves.

Respiration. The thousands of cells that make up the plant or plant part that we know as a fruit or vegetable carry on living processes. Through the process of *respiration* the cells break down carbohydrates to liberate stored energy necessary for life. The compounds they break down (oxidize) are those that were produced in the leaves by photosynthesis. This respiratory process continues after the fruit or vegetable is harvested. As it continues, heat is released, and carbon dioxide and water are formed. The speed of the reactions that take place during respiration varies with the type of plant and the temperature. The lifespan of a vegetable or fruit (after harvesting) is dependent upon the speed, or rate, of these respiratory reactions. Temperature is a factor in controlling the rate of respiration, and proper storage temperatures (36° F to 38° F) (2 to 3° C) prolong product life by slowing down the rate of respiration.

Maturity. *Maturity* is reached at the point where growth ceases, the seeds are fully developed, and the item is at the stage of development where the ripening process will ensue. Practically speaking, maturity is relative. Different fruits and vegetables have different maturity requirements that relate to their use and acceptability.

Ripeness. A fruit or vegetable is "ripe" at the stage of development when enough of the starches have been converted into sugar to make the product fit for use. The flesh ordinarily yields to moderate pressure and the product is in prime eating condition. We will discuss maturity and ripeness later when we discuss the factors that determine the quality and condition of fresh fruits and vegetables.

Exercises (633):

1. Match each name of a physiological process described in column B with its related physiological process in column A. A name of a process may be used only once:

Column A	*Column B*
___ (1) Excess water, absorbed through the roots, is given off by stomata in the leaves.	a. Respiration.
___ (2) The starches have been converted into sugar to make the product fit for use.	b. Ripeness.
___ (3) Manufactures essential chemical components for plant growth.	c. Transpiration.
___ (4) Growth ceases.	d. Photosynthesis.
___ (5) Breaks down carbohydrates.	e. Maturity.

634. Ascertain the validity of selected conditions/requirements concerning temperature control.

The storage conditions of fresh fruits and vegetables must be optimum if the item is to maintain its characteristic appearance and taste. Thus when inspecting fresh fruits and vegetables, you must be concerned not only what the item looks like but also what the storage conditions were and will be like.

Temperature Control. The proper storage of perishable fruits and vegetables extends their life and is essential to:

- Allow distribution before spoilage.
- Provide seasonal items for longer periods.
- Retain surplus items for times of shortage.
- Provide items in geographical areas where they are either short or nonexistent.

This extension of life is accomplished by controlling the temperature and, to a lesser extent, the atmosphere. When you attempt to control the temperature, you should know how different temperatures affect various fruits and vegetables. Cold is the absence of heat; so temperature control (refrigeration) is nothing more than removing heat.

Heat effects. The enzymes contained within living organisms bring about changes in color, texture, and chemical composition after harvest and throughout storage. These changes generate internal heat which hastens ripening and ultimate deterioration. In your job, you must be aware of three types of heat and their effects on shipping, storage, and distribution of fruits and vegetables: (1) field, (2) vital, and (3) container.

Field heat is externally generated heat. Its fast removal favorably sets the color, flavor, and texture, and also retards enzymatic action. Preferably, it is removed as soon as possible after harvest, sometimes during field packing. Two methods of removing field heat are: (1) hydrocooling (ice and water) in the packing shed, and (2) vacuum cooling in the shed, car, or crate.

Vital (latent) *heat* is produced as a byproduct of respiration and other chemical changes during transportation and storage. Experts use this heat to determine the relative temperature and humidity requirements for different species. For instance, peaches, lettuce, and peas generate more vital heat because they have higher respiratory rates, while potatoes, onions, and apples generate less vital heat because of lower respiratory rates. Ways of decreasing vital heat and slowing respiration include refrigeration, waxing, wrapping, and harvesting at a less advanced stage of maturity.

Container heat is that acquired from the actual container material, from the interior surfaces of the warehouses and transport vehicles, and from the surrounding atmosphere. This ambient temperature must be carefully controlled in refrigeration and storage holding. Lowering storage temperatures retards the growth of bacteria and fungi and slows respiration and ripening. Raising storage temperatures has the opposite effect; an increase of 18° F will approximately double the respiratory rate.

There is no particular relative humidity (RH) that is optimum for the storage of all fresh fruits and vegetables. Generally, leafy green vegetables require a high RH, 90 to 95 percent. White onions, garlic, melons, and squash need as lower RH, 70 to 80 percent. Most other fruits and vegetables store well at 80 to 90 percent RH. A good rule of thumb is to maintain a humidity equal to or slightly above the normal moisture content of the product, somewhere between 80 and 98 percent. AFCOMSR 145-2 provides information that will serve as a guide for the storage of fresh fruits and vegetables. The data in this manual are not to be used as hard-and-fast rules, only as general guides.

A refrigerated room that is full of produce will usually maintain humidity at a satisfactory level. An almost empty room needs an additional source of moisture to overcome evaporation caused by refrigeration. Wet ice and water spray are methods that help. Since any solid object, to a degree, will collect or discharge moisture when sudden changes in temperature occur, ventilation is a necessary requirement to keep this moisture in the air and off the product.

A relatively new storage practice is the controlling of the atmosphere to which the fruit or vegetable is exposes. *CA*, as controlled-atmosphere is commonly called, originally was suited only to apples. CA is a process of replacing the oxygen in the atmosphere with inert gases. This replacement reduces the rate of respiration of the item and decreases degeneration. Some commodities benefit from low-oxygen atmospheres and have extended life, while other items are harmed, and their storage life is reduced. By extending the life of a commodity, storage is prolonged, and the product can be transported farther and be distributed on markets that were previously inaccessible. The Navy uses CA in the storage holds of ships, thus providing the men afloat and abroad with fresh produce, which was previously not possible. The full potential is yet to be derived from CA. However, all products, as previously noted, do not respond equally to low-oxygen atmospheres, and some are not suited to this treatment.

Two principal techniques are used to reduce the percentage of oxygen in CA storage rooms. The first uses displacement of oxygen by carbon dioxide in the natural respiration of the fruit. In this process, however, provisions are made to prevent excessive accumulation of carbon dioxide, which could be harmful. The second method involves the circulation of an atmosphere of the desired composition (produced by commercial generators) through the storage rooms to replace normal air. By this method, the oxygen content is lowered sufficiently in a matter of hours, or at most a few days, much faster than by the first method.

Many fruits and vegetables have been tested in CA storage to determine the most suitable atmospheric conditions or temperatures for prolonging their life. The most successful CA storage is for apples. Each apple variety differs in oxygen, carbon dioxide, temperature, and RH required, and some varieties have been sucessfully stored for 7 to 8 months at 38° F (3° C). CA allows growers and others, selling fruits and vegetables that are adaptable to CA, an extended period for marketing and more flexibility in choice of time to market.

Now that you have studied basic plant physiology and have also reviewed the principles of the storage of fresh fruits and vegetables, you are ready to take up the inspection of fresh fruits and vegetables.

Storage Practices. If the storage life of fresh fruits and vegetables is to be lengthened, the plant's rate of respiration must be slowed. The slowing down of respiration is accomplished by controlling the heat through refrigeration, controlling the humidity, and possibly controlling the atmosphere.

Each fruit and vegetable species has an optimum storage temperature; however, most fruits and vegetables can be safely stored at 32° F (0° C), while some must be held at about 45° F (7° C). We will look at specific temperature requirements later. The storage temperatures should not fluctuate. Fluctuation results in increased evaporation at high temperatures followed by condensation at low temperatures. This robs the produce of water, leaving items in a shriveled and unpalatable state. Although freezing temperatures retard the growth of fungi and bacteria, slow respiration, and slow the ripening processes, certain fruits and vegetables are seriously injured by such low temperatures. A fall of 2° F or 3° F below freezing may injure plant tissue and make the product unfit to eat. For instance, incompletely ripened tomatoes, though mature, will develop a water soft rot rather than ripen if stored at improper temperatures. A typical vegetable retains its essential sweetness for only 1 day when stored at 80° F (27° C) but for 14 days when stored at 40° F (4° C).

You must recognize the results of malpractices in refrigeration. Some objectionable outcomes of improper heat control are as follows: Potatoes stored for a few weeks at temperatures below 40° F (4° C) develop a sweet taste because of enzymatic action which converts the starch to sugar. Fried potatoes and potato chips made from such potatoes will have a dark brown color. Cucumbers usually develop pits and dark, watery areas if held 10 days or longer under 45° F (7° C). Summer squash develop severe pitting in about 8 days if stored at 32° F (0° C) to 45° F (7° C). Under similar conditions, unripe melons undergo definite damage. Honeydew melons, cantaloupes, eggplant, and sweet peppers all may show chilling injury. Some of the subtropical fruits, such as pineapples, bananas, avocados, and olives, are also susceptible to chill injury. Grapefruit and lemons may develop abnormal skin or flesh, if stored for several weeks at temperatures below 50° F (10° C).

Heat and humidity are closely related in their importance in storage. *Humidity* is a general term descriptive of wetness, or the moisture content of the air. *Relative humidity* is the ratio (expressed as a percentage) of water vapor actually present in air compared to the greatest amount of water vapor possible in the same air at the same temperature. Thus a relative humidity (RH) of 100 percent expresses an atmosphere that is completely saturated (fig. 2-1).

Each degree of temperature change effects the relative humidity—the capability of the air to hold more or less water at the new temperature. A rising temperature increases both the rate of evaporation and the capacity of the air to hold water. As the temperature rises, more water evaporates from the plant. This evaporation (or drying out) affects the quality of fruits and vegetables during storage. It can cause a loss in weight or a change in the texture, as evidenced by shrinkage or wrinkling. The rate of evaporation is affected by the relative humidity of the atmosphere in the storage room. On the other hand, if a saturated atmosphere cools, condensation occurs, and the water, once lost, is not reabsorbed by the plant, but collects and establishes a breeding place for unwanted mold and bacteria.

Exercises (634):

Indicate which of the statements in exercises 1 to 13 on temperature control is true (T) and which is false (F). If any is false, correct it.

T F 1. Latent heat is externally generated heat.

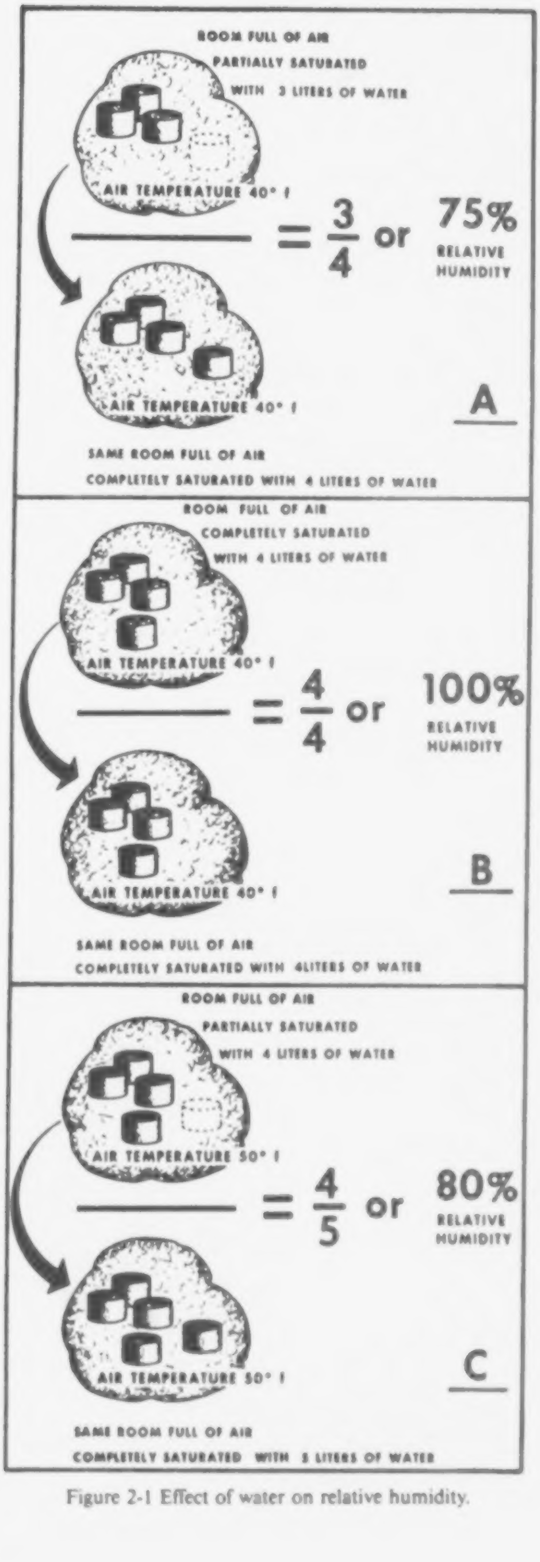


Figure 2-1 Effect of water on relative humidity.

T F 2. The slow removal of field heat favorably sets the color, flavor, and texture of the product.

T F 3. Harvesting at a less advanced stage of maturity is a means employed to decrease vital heat and slow respiration.

T F 4. An increase of 18° F will approximately double the respiratory rate.

T F 5. When employing methods to control the ambient temperature, we are concerned with controlling container heat.

T F 6. Leafy green vegetables require a low RH of 80 to 85 percent.

T F 7. Squash requires a RH of 70 to 80 percent.

T F 8. A refrigerated room that is full of produce needs an additional source of moisture to overcome evaporation caused by refrigeration.

T F 9. Fluctuation of temperatures results in increased evaporation at high temperatures followed by condensation at low temperatures.

T F 10. The optimum temperature for the storage of cucumbers is below 45° F.

T F 11. Condensation caused by fluctuation of temperatures is reabsorbed by the fruits and vegetables in storage.

T F 12. CA (controlled atmosphere) is a process of replacing the oxygen in the atmosphere with inert gases.

T F 13. Each degree of temperature change affects the relative humidity.

635. Pair statements concerning product characteristics with their correct inspection criteria.

Inspection Criteria. There are three inspection criteria with which you should be familiar—condition, quality, and grade. There is a definite distinction among these, and you should clearly understand the difference. This includes:

- Condition—This concerns such factors as decay, disease, freedom from insect damage, and internal, unseen factors inherent to that particular product.
- Quality—This can be broken down into appearance, texture, and flavor categories; quality includes also such characteristics as maturity, color, and surface blemishes.
- Grade—When correlated to US standards, this refers to the sum of the characteristics of the commodity at the time it is graded, including both quality and condition factors.

Condition. Since condition defects are of a progressive nature, the condition of fruits and vegetables is subject to change in transit or storage. Condition factors are divided into two categories—*biological* and *physical.* These factors are quite varied in nature, but all of them can reduce produce to a very poor condition. You must continually be on the lookout for poor condition factors while inspecting fresh fruits and vegetables; in many instances, condition will be your primary concern during an inspection. Let's look at biological and physical conditions factors in turn to see what causes poor condition in fruits and vegetables.

Biological factors. These are a result of living organisms and physiological processes. Bacteria and mold can cause the product to decay or rot. Remember, decay is progressive. Do not overlook decay because it is only in small spots on the fruit; after a time those spots will enlarge and render the fruit inedible. Insect damage is also an important condition factor. Most often insect damage is a readily noticeable condition. You must pay close attention, however, to fruits and vegetables because sometimes a tiny hole in the skin will lead to a large area of damage on the inside. Never hesitate to cut open a few of the items in question to satisfy yourself that they are in good condition.

We have already discussed ripeness in the section on physiological processes. Now let's look at this factor as it relates to condition. You will recall that we said the physiological processes continue in fruits and vegetables after they are harvested. We must be well aware of this matter, because it is the basis for many of our procurement and storage practices. We must take into consideration the fact that during the time between harvest and use, many products continue to ripen. Without considering this point, produce would be purchased in a ready-to-eat stage but would not be scheduled for use for several days or a week. The result would be a product that is overripe at the time of use. This problem is solved by buying products that have not yet reached the usable stage of ripeness. Then, during storage or shipment, the ripening process can continue; so by the time the products are used, they will be at the desired stage. For example, tomatoes and pears must be picked in a mature green state, if they are to be consumed after any great time in storage.

Physical factors. There are many physical condition factors with which you will need to be familiar. They are caused by highs and lows in temperature, chemicals, or rough handling. Heat injury (sunburn or scald) primarily affects apples, peppers, and tomatoes. A scarcity of leaves allows too much sun to penetrate and results in the damage. Another type of heat injury is caused by high temperatures during the washing process; for example, oranges so washed develop burnt and dried-out skins. On the other hand, in a low-temperature injury (chill or freeze damage), ice crystals from which crush cells and result in loss of juice.

Another physical cause of condition defect is the improper use of chemicals during processing. The following chemicals are responsible for noticeable changes in appearance as stated:

- Hydrochloric acid. This produces light tan burns on the product's skin.
- Sodium silicate. This causes brown areas on the product's skin.
- Sulfur dioxide. This results in gray sheen on the product. (If excessively used for fumigation purposes.)

Of the physical factors, we inspectors most commonly encounter mechanical injury or damage. Within this area, *bruising* (crate pinching and rough handling) is most frequent. Through bruising, cells are mechanically crushed; thus, the product's barrier to biological disease or to chemical damage is destroyed.

Condition defects may also occur in combinations. Consider *penicillium rot* (blue mold), a common biological disease that affects apples. The cells beneath the skin carry on their natural processes, even though the blue mold spores contaminate the skin. These spores are carried by the air. Under ideal conditions (temperature of 50° F to 60° F (10°-16° C) and high humidity) the spores germinate and grow, and within 4 to 5 hours, spread across the apple's skin surface. The growth causes little or no damage to the fresh apple itself, until mechanical damage occurs. Since food and moisture are available, a break in the skin implants the organism, and disease in the tissue ensues almost immediately. Under less favorable conditions, such as lower temperatures, the disease requires a longer time to establish itself. As the disease progresses, cells die and disintegrate and, thereby, release cell fluids. These cell fluids flood the spaces between adjacent cells and cause a water-soaked appearance as evidence of the ravages of rot. This water-soaked appearance requires 4 to 7 days to develop. A later development of the disease results in a drying out of the diseased tissues which then take on a brown appearance. In more advanced stages, the external mold can be seen with the naked eye.

There are many factors leading to the poor condition of fruits and vegetables, most of which originate from a combination of causes. The signs may vary, but rough handling and bruising are too often the triggering agents. The upset physiological patterns observed are often similar to those described for blue mold. The water-soaked appearance is usually the first sign noted. The structural and physical changes vary as to temperature, humidity, and the exact cause.

Quality. Some of the factors that influence the quality of fresh fruits and vegetables are appearance, texture, and flavor. These are in turn determined by the ripeness and maturity of the product as well as the surrounding atmosphere. The effect of each factor on the product is important to your inspection. An evaluation of these factors will assist you in determining the remaining storage life of fruits and vegetables as well as aid you in advising on the product's acceptability.

Criteria that figure into the determination of quality are the appearance factors—*color*, *shape*, and *surface blemishes*. These factors weigh heavily during the grading of fruits and vegetables. Remember, because most of the time the USDA will have already graded these items, you will not be greatly concerned about minor quality defects. If you should feel, however, that there are enough quality defects to cause you to question the grade of a lot or shipment, you can request that a formal review or grade reinspection be performed by the USDA. Remember that you are concerned with saving the Government money, and money would be wasted if US No. 2 potatoes were bought at US No. 1 prices.

Grade. The fruit and vegetable market has a definite need for uniformity in inspection procedures. Buyers and sellers, including Government purchasers, even though separated by thousands of miles, need to know precisely what each other is talking about. Identifiable grades permit buyers and sellers to understand each other. Grading and the initial inspection of fruits and vegetables have been a primary function of the US Department of Agriculture for many years. The USDA's guidelines or requirements for each individual product were not set up overnight, but have been in a continuing process of development—one that is still changing.

Its grading system for fresh produce is based on condition, quality, appearance, and other factors that affect edibility and waste. The grading standards were established with the cooperation of growers, marketers, and technicians throughout the industry who are specialists in each commodity considered. The grade rules, supplemented by State grading regulations, become the basis upon which trading is conducted in the industry.

Grades are generally designated by names, numbers, or a combination of both. *US Fancy* (or *Extra Fancy*) is the top grade, reserved for those products of high color and of practically no defects. Since little of a crop is free enough of defects and injury to rate this grade, it demands premium prices. The basic trading grade is *US No. 1*, in general the highest grade of good average quality that is practicably packed under commercial conditions. This grade is the one most generally purchased by the military. Approximately 50 percent of the crop, under normal growing conditions, is of this grade. Between *US No. 1* and *US No. 2* is an intermediate grade for quality standards not high enough for No. 1 but above No. 2. This intermediate grade is *US Combination* (US Commercial) and is often used to describe the pack of a crop that is below average quality because of abnormal growing conditions. Consequently, US No. 2 grade ordinarily represents the quality of the lowest grade that is practicably packed under normal conditions. In addition, there are miscellaneous grades applying only to particular products: *US No. 3*, citrus; *US Utility*, apples; *US Hail Grade*, apples and pears; *US No. 1 Bright*, *Bronze*, or *Russet*—used for citrus; *Combination US Fancy and US No. 1*; *US Extra Fancy*, used for apples; and *US Extra No. 1* used for pears, peaches, potatoes, and celery. The one thing to remember about grading is that it is never, except in cases of specified local contracting, the responsibility of military environmental medicine specialists; but experience teaches you to be fairly accurate in recognizing grades as you inspect shipments of USDA graded products.

One thing to remember about grading is that it is, with the exception of specified local contracting, seldom your responsibility. Experience and your use of directives listed in the next section will teach you to be accurate in recognizing grades as you inspect shipments of USDA graded products.

Exercises (635):

Match each inspection criteria in column B with the appropriate statement concerning product characteristics in column A. Each inspection criteria may be used once or more than once.

Column A

___ (1) The general appearance of a product is being examined.
___ (2) During this type of inspection, you may have to cut open a particular item.
___ (3) Light tan burns on a product's skin caused by the use of hydrochloric acid.
___ (4) Evaluative system based on condition, quality, appearance, and other factors that affect edibility and waste.
___ (5) Blue mold affects apples and is a biological factor.

Column B

a. Condition.
b. Quality.
c. Grade.

636. Determine the validity of conditions/statements about publications used by food inspectors.

Inspection Directives. In order to perform a meaningful inspection of fresh fruits and vegetables, you will need to have on hand, and be familiar with, certain directives used by Air Force food inspectors. We will briefly discuss the general content and use of several of these important publications.

Specifications. Specifications give a detailed description of the specific requirements for the product concerned. Often, though, specifications for fresh fruits and vegetables list some of the requirements for the product concerned. Often, though, specifications for fresh fruits and vegetables list some of the requirements, but they refer the inspector to the applicable US Standard for a more detailed coverage of the specific requirements for that item. This leads us to the next category of publication we should discuss—the United States standards for fresh fruits and vegetables.

United States standards. These directives, published by the USDA, give much of the information that is needed for the proper examination of a product. The US standards for asparagus, for example, list the possible grades for that item. They describe in great detail the requirements for each grade and give the tolerance allowed for undergrade items. Some very valuable information, also found in US standards, is a list of definitions of many of the terms used to describe grading factors. For example, you are inspecting a shipment of US No. 1 grapefruit, which calls for fairly well-colored fruit. What does this mean? This could be interpreted differently by different inspectors; however, the US standards define "fairly well-colored" in such a manner that everyone should interpret it in the same way. Because of the useful and often necessary information found in US standards, they should be readily available when you are performing an inspection of fresh fruits and vegetables.

Master solicitation. The DPSC Master Solicitation is published by Headquarters Defense Personnel Support Center (HQ DPSC). The information contained in the master solicitation states the general conditions and terms of requests for proposals (RFP) and provisions of resulting contracts issued by HQ DPSC, Defense Supply Region Pacific (DSR PAC), and Defense Supply Offices (DSOs). When the solicitation is incorporated in the request for proposal (RFP) or blanket purchase agreement (BPA), all of the provisions will apply. The master solicitation is issued on a one-time basis; it is very important and, therefore, should be retained for future use.

Purchase description. We have looked at several publications that you will need to use to perform an inspection of fresh fruits and vegetables. Now let's look at another, the purchase description, which is usually found in the contract. It is used to describe qualifying factors that are unique or that are higher than those incorporated in the grade specifications. Sometimes the applicable US standard is quoted to serve as the purchase description.

Exercises (636):

If one of the statements in exercises 1 to 4 on inspection directives is correct, mark it true (T); if it is false, mark it false (F) and correct it:

T F 1. Specifications for fresh fruits and vegetables describe in great detail the tolerance for each grade and the tolerances allowed for undergrade items.

T F 2. Specifications for fresh fruits and vegetables will often refer you to the applicable US standard for more detailed information or specific requirements.

T F 3. DPSC Master Solicitations give general terms and conditions of RFPs and provisions of resulting contracts.

T F 4. The purchase description is usually found in the contract.

637. Designate the validity of definitions/requirements pertinent to Government purchasing procedures.

Government Purchases. Fresh fruits and vegetables are purchased either by DPSC, Defense Supply Region Pacific (DSRPAC), Defense Supply Offices (DSOs), or under a local purchase contract, blanket purchase agreement (BPA). Local purchases can be single shipments, split shipments, or shipments over an extended length of time, such as a month, 6 months, or even a year. The term for an extended time contract is *blanket purchase order*. Under a blanket purchase order, prices may be adjusted each month to compensate for overall market increases or decreases. DPSC contracts are for large quantities to be shipped to depots or several military installations and allow three different methods of purchase: (1) street buying (terminal market), (2) field buying and (3) written solicitation. The first two methods entail an actual visual inspection of the products; whereas written solicitation buying does not.

Street and field buying. *Street* (terminal market) and *field buying* are alike in that both use a visual selection procedure. The buyer makes visual comparisons between products of competitive suppliers and awards the contract to that vendor with the best buy to the Government as to price, quality, condition, and other factors. In street buying, the buyer visits a local or terminal market. Purchases are usually less-than-carlot (LCL) or less-than-trucklot (LTL) shipments and primarily on a best-buy. The buyer will purchase a USDA graded product, if available. In field buying, the buyer visits the growing areas or field parking shed facilities to observe and inspect the products as they are being harvested and packed. This type of purchase is primarily carlot (CCL) and trucklot (TL) shipment, 20,000 or more pounds. A USDA graded product is purchased for overseas. In both methods, the buyers usually carry small looseleaf notebooks and record all offerings on DPSC Form 2176 Site Buyer's Worksheet of Offering.

These are some of the criteria used for purchase: (1) samples must be selected at random; (2) assurance is given that the supplier has sufficient quantity of product on hand to meet contract requirements; (3) the buyer and seller both have a complete understanding of the terms and conditions of the contract, placing special emphasis on price, grade, condition, maturity, size, and other qualifying factors; (4) designation is made of an ceptance point where supplies are to be inspected for contract compliance and acceptance by the government; and (5) there is agreement that if all or part of the supplies delivered are not in accordance with award agreement, they are subject to rejection.

Precautions are also taken to assure that products delivered are those actually selected. These precautions include: (1) the buyer annotates DPSC Form 2176 with brand, trade name, or other distinguishing marks; (2) the buyer may identify a representative number of containers by stamping, with a rubber stamp, region, purchase date, and other dates; and (3) the buyer follows through to greatest possible degree to insure that the products delivered are those actually selected and awarded.

Written solicitation. This type of purchase is kept to a minimum, and in no instance is it considered proper to use a written solicitation concurrently with street or field buying for the same items. This type of purchase is for carlot or trucklot shipments for overseas shipment. The products purchased will be in accordance with a USDA grade and, in all cases, with a verified USDA inspection. In this type of buying, the subsistence procuring element (SPE) prepares written notification of the intent to purchase a specified product of a certain quantity and grade. These written notifications are then sent to prospective vendors. The prospective vendor who submits the most desirable offer is then awarded the contract. The successful supplier must furnish a USDA certificate of inspection to substantiate contract compliance inspection.

Since we are looking at buying from the inspection angle, let's examine some malpractices connected with buying based on the lowest responsive price, particularly as it relates to local purchase of fresh fruits and vegetables for resale. Condition and abundance of produce are major factors in determining price. Deteriorated items are sold at prices in direct ratio to their degree of deterioration.

In order to preclude losing money (because of a low bid made in a rising market), contractors may endeavor to substitute lower quality merchandise, such as old produce that has been repacked. Contractors may resort to attempting deliveries at short weights which cannot be detected unless you are really alert and weigh 100 percent of the produce. For example, a vendor may take several hampers of green beans, dump them, fluff them up, and water them just before delivery and get credit for an additional hamper.

Exercises (637):

If one of the statements in exercises 1 to 4 concerning Government purchasing procedures is correct, mark it true (T); if it is false (F), mark it false and correct it:

T F 1. In street buying, the procurement agent visits the growing areas or packing facilities.

T F 2. When field buying, the procurement agent inspects and observes the products being harvested or packed.

T F 3. Local purchases on extended time contracts are referred to as *blanket purchase orders.*

T F 4. When a contract is put out on notification of the intent to purchase and awarded to a vendor who submits the most desirable offer, we are buying in accordance with the field buying method.

638. Identify the proper agency, documents, and procedures involved in contract compliance.

Contract Compliance. Inspection of fresh fruits and vegetables (FF&V) for grade, unless otherwise directed by the procuring contracting officer, must be accomplished by the Consumer and Marketing Service, U.S. Department of Agriculture (USDA) or Federal-State Inspectors.

Other requirements and conditions that you need to be aware of that are part of also the inspection and acceptance of FF&V include the terms "carlot" and "trucklot"; these are used in contracts to mean a quantity of 20,000 or more pounds and can be of one type of product or more. In addition, each trucklot or carlot purchased from one contractor must be given a preliminary inspection at the time of shipment or while enroute at the request and expense of that contractor. Railcar numbers and/or truck or trailer license numbers must be listed on inspection certificates. On shipments of less-than-trucklot (LTL) or less-than-carlot (LCL) quantities purchased in an amount of less than $750.00 for direct vendor delivery (DVD) to destination or docks, the contractor can inspect the product at origin and furnish a certificate of conformance (COC) for all terms of the contract. The contractor must also cite the contractual requirements for which the certificate is furnished and state that USDA inspection is not required. For contract amounts of $705.00 or more, a USDA inspection is required at the request and expense of the contractor.

A USDA inspection at the request and expense of the contractor is required on replacement shipments of rejected lots of FF&V. If official USDA or Federal-State inspection is not available at origin (when required), the contractor will furnish, with that individual's invoice for the LTL or LCL shipments requiring origin USDA inspection, a COC with the added statement, "Inspection service not available." Acceptance inspection for identity and condition must be performed at destination for those FF&V products procured free-on-board (f.o.b.) which received, as a contractural requirement, an earlier inspection by the USDA at the contractor's expense.

If the destination inspection is accomplished by the USDA inspection for all terms of the contract, the inspection results will be final.

If any other agency other than the USDA performs the destination inspection, the results will be final unless the contractor specifically asks the procuring contracting officer (PCO) for a formal review (reinspection) by the USDA. A formal review, if authorized by the PCO, must be performed in accordance with USDA procedures. The results of this reinspection performed by the USDA will be final. In the event the results of the formal review establish nonconformance with the contract requirements, the cost of the inspection must be borne by the contractor. If results of the formal review establish conformance with contract requirements, the cost of the inspection will be paid by the Government.

Products submitted at destination on a COC in accordance with contract requirements will be inspected for all terms of the contract. The results of the destination inspection will be final unless the contractor specifically requests to the PCO for a USDA inspection. If the results of the USDA inspection establish nonconformance of the product, the contractor will be charged for the inspection service. In the event the inspection results are conforming, then inspection services will be borne by the Government.

Official inspection certificates furnished by USDA or Federal-State inspection, when required, must be attached to the original copy of the invoice; additionally, the number of the official certificate must be annotated on the invoice. On trucklot or carlot shipment, a copy of the inspection certificate must accompany each shipment. For LCL or LTL shipments, one copy of the inspection certificate, when required, must accompany each shipment.

The shipments requiring the contractor to provide the USDA inspection certificate, but which were received without this certificate, must be inspected at the request of the Government, but at the expense of the contractor.

Sanitary Conditions in Establishment Furnishing Subsistence. During the length of the contract, the sanitary conditions in the factory or plant in which the work is performed are subject to the inspection and approval of the contracting officer. When the contracting officer determines that such conditions are detrimental and should not be permitted to continue, that individual may suspend the work until such conditions are remedied to his or her satisfaction. Suspension of the work should not extend the period of the contract, nor will it be considered sufficient cause for the contractor to request an extension of any delivery date. In the event the contractor fails to correct such objectionable conditions within a period of time specified by the contracting officer, the Government has the right to terminate the unexpired period of the contract.

Sanitary Conditions in Delivery Vehicles. The products delivered under contract must be transported in clean vehicles. The vehicle must be maintained in a sanitary condition to prevent contamination of the supplies and should be equipped to maintain any temperature requirements prescribed in the specification or elsewhere in the contract. The vehicles are subject to inspection by the Government at all reasonable times and at all places, including the plant of the contractor. Supplies, received for acceptance in vehicles which are not sanitary or which are not equipped to maintain any required temperatures, should be rejected without any further inspection.

Exercises (638):

1. What agency, when required by the contract, normally inspects fresh fruits and vegetables for Government purchase?

2. What quantities do the terms "carlot" or "trucklot" represent?

3. A contractor is allowed to furnish what type of inspection certificate on LTL or LCL shipments of less than $750?

4. For contracts of $750 or more, what type of inspection certificate is required?

5. A shipment of FF&V arrives at your base, and you note that the product has been USDA inspected as a contractual requirement. You check the contract more closely and see that the shipment is f.o.b. destination. What will your inspection pertain to in this instance?

6. FF&V received at destination on a COC are inspected for all terms of the contract and are found nonconforming. The contractor requests a formal review by the USDA, and the inspection establishes that the products are conforming. Who will be re-

quired to pay for the inspection services of the USDA?

7. You receive a shipment of FF&V without the required USDA inspection certificate. What action should you take?

8. The contracting officer determines that the sanitary conditions of a plant furnishing FF&V are detrimental. The contractor fails to correct the conditions within a period of time specified by the contracting officer. What action may the Government take in this instance?

9. What are the requirements for vehicles in which FF&V are to be transported and delivered?

10. Where and when can vehicles used by the contractor to transport FF&V be inspected?

2-2. Semiperishable Subsistence

"Nonanimal origin subsistence" is usually classified in food inspection terminology as *semiperishable subsistence*. This type of product is seen as a "hardy" item; it takes this product considerably longer to deteriorate under the most adverse environments—environments that would render perishable items unfit for further use.

In this section, we will look at the types of semiperishable subsistence commonly stored in Government warehouses. We will discuss the ways in which these items can be damaged, or rendered unfit for use, as well as the ways in which they can be protected from loss and allowed to remain as the foundation of the subsistence procurement system.

Semiperishable subsistence is difficult to judge for quality under sensory evaluation, because such items do not display the normal symptoms of deterioration we associate with spoilage; i.e., loss of flavor, discoloration, and off-odor, slime, and product breakdown. The products may be unfit and still display normal color and appearance.

As a food inspector, you need to be familiar with the characteristics of semiperishable subsistence; i.e., the characteristics of a normal product, the characteristics of an abnormal product, and the characteristics of a product no longer fit for its intended use.

639. Describe the factors associated with the inspection of nonanimal origin subsistence.

Types. What do we visualize when we see the word "nonanimal"? What food items do you associate with the word? As a rule, there are specific types of foods allotted to this classification; rather than outline them all, we will give you a few examples.

Flour, rice, nuts, coffee and tea, spices, macaroni—all these are classified as "nonanimal," or *semiperishable subsistence items*. Each has peculiar characteristics regarding storage requirements, the ability to maintain quality under certain environmental stresses, and displays deterioration to the inspector.

There is a difficulty in determining deterioration in the semiperishable subsistence category. To each of us, these particular products have certain qualities that make them appealing. In the same respect, these same qualities may make the same item unappealing to another. Determining quality, and thus usability, strictly upon a product's appeal to you, the inspector, is a poor means of evaluating that product's potential for use.

We must be aware of the commercial standards of quality inherent in each semiperishable item we inspect. This includes the packaging of the product, bacteriological standards that may exist for the product, and the recommended storage life that commercial producers have ascertained for that product. Items such as beverages, fats and oils, and leavening agents also fall into this category.

Depending upon the item being inspected, both the packaging and the storage environment may play a significant role in the long-term probability for deterioration and loss. We need to discuss these aspects of storage and your responsibilities towards insuring that the Government's financial interest is protected. To do this, we will take the basic factors associated with sound packaging and storage and discuss each.

Packaging. The basic purpose of any packaging material is to protect the packaged product from damage and contamination, as well as deterioration. Depending upon the stability of the product being packaged, one or more of those prime considerations may be of greater importance. An example would be the difference in container design and function when looking at the way fresh milk and fresh eggs are packaged. Fresh eggs are packaged to protect the individual eggs from damage while providing each with proper amounts of cool air through spacing of the eggs. Fresh milk is packaged to prevent contamination of the milk, allow for maximum exposure of milk to the refrigerated air outside the package, and keep the milk from being absorbed by the packaging.

So the need to protect the product is the primary purpose of packaging, though, as you have seen, many other motives exist. When a package, or packing material is damaged to the point where it can no longer protect its contents from damage or contamination, then the product will deteriorate at an accelerated rate. You need to take the time to evaluate the packaging of products in your warehousing area—are they protecting the product, or are they no longer fit to provide that protection?

Storage Environment. The area in which these food items are stored plays a critical role in the ability of a food item to maintain its natural composition and to remain free of excessive contamination. Humidity, pest infestation, improper sanitation, temperature excesses, and inadequate stock rotation all play a part in the deterioration of a warehousing facility. Let's look at each of these factors.

Humidity. Moisture is a prime requisite in the growth of all life. In stored foods, that growth includes molds, yeasts, and bacteria that may very well render a food unfit for human consumption. Humidity, in combination with excessive heat or cold, may cause chemical breakdown in many types of foods that will also render the food unfit for consumption. Humidity can be controlled, and in this environment, it is a *must*. AFCOMSR 145-2 holds valuable information on the humidity requirements for the storage of many types of food items. Become familiar with this information.

Pest infestation. Simply put, rodents and insects destroy approximately ten million dollars of Government-owned subsistence yearly. What they do not contaminate through package damage and consumption, they render unfit merely by urinating or nesting among these food items. They are brought into warehouses aboard pallets of foods, and unless the facility has a sound and active sanitation program, they will quickly infest the warehouse.

Sanitation. Sanitation is the most effective, and the longest lasting, means of controlling insect and rodent infestation. Clean, well-ordered warehouses will not support an insect or rodent population—it really is that simple.

Stock rotation. When foods are allowed to remain in storage past the recommended shelf life, they begin to deteriorate. If left long enough, they will deteriorate to a point where they are no longer fit for use. All Air Force food service agencies require an active stock rotation program in their warehousing facilities. The simple rule for stock rotation is this: "First In—First Out" (FIFO). You have heard this before. Still, you need to use this easy slogan to train warehouse personnel in the need for proper and timely stock rotation.

All right, we have looked briefly at the packing criteria used to protect foods. We have also looked at the storage environment to see why it is so important in the protection of foods. What does all this mean as far as the nonanimal origin foods are concerned? What affects will these negative conditions have on these food products? Let's find out.

Beverages. Heat and cold will destroy the condition of most canned, bottled, or cartoned beverages. The sugars and sweetners used in these products will crystalize and sink to the bottom of the container. The heat may effect the exterior of the packaging, causing leaks and loss of product, as well as providing an attraction for insects and rodents.

Fats and Oils. Fats and oils are made from many different sources. Animal fats, vegetable fats, and even certain chemical combinations are all recipes for preparing cooking fats and oils. Again, heat and cold can destroy the condition of these products. These items attract insects and rodents, though rodents will more often be the culprit. They are high in proteins and moisture content, and can provide excellent media for bacterial growth. They can contaminate other stored products, once they are freed from their packaging.

Leavening Agents. Leavening agents, like yeast and baking soda, are used to bind grains together during baking and trap air within the baked product. They are activated by heat, basically, and excessive heat in a storage environment may very well render these agents unfit for their intended use. Again, insect and rodent damage would preclude any use of these products.

Grains. Grain or cereal products are a varied and large classification within the semiperishable family of subsistence items. Flour, bread, crackers, rice, barley, oats, prepared cereals, noodles—these subsistence items are but a few of the group. They appear sturdy and invulnerable when you look at them superficially. Yet, when you look at the ways in which they can be spoiled, damaged, or contaminated, they suddenly take on a new importance.

Humidity is a deadly enemy to grain products. At the least significant end of the discussion, moisture may render a grain product unfit for its intended use; it is not lost to the Government, but it will not be used to make bread or whatever else it was scheduled to do. At the worst end of the discussion, moisture contributes to mold, yeast, and bacterial growth in grain products. Here, disease transmission becomes the danger. It is known that some molds produce a toxin so potent that death becomes a foregone conclusion when the toxin is ingested. You've already read an extensive discussion on what bacterial contamination can do to the consumer.

Sugars. Sugars, or sweetners, are also extremely vulnerable to moisture. They, like grain products, are also vulnerable to attack from stored product pests; i.e., insect and rodent. The damage and contamination that occurs each year to the Air Force subsistence inventory carries into the millions and millions of dollars. Though rodents and insects are commonly accepted as filthy visitors and unwanted tenants, some of the warehousing facilities in the Air Force pay little attention to the control of either. Sugars can deteriorate, breaking down into substances unfit for use at any level of food preparation. It is imperative that the food inspector understand the vulnerability of this food item and protects it as much as possible during its storage.

Coffee and Tea. These beverage items can spoil. There have been cases in which coffee sold to the Armed Forces was produced and canned using soured coffee beans. There have also been cases in which tea sold to the military was so totally infested with insects that the lot had to be burned in order to minimize the infestation in the warehouses. These items are not insignificant. They are grown outside, processed outside, and in some cases, packed outside. The quality control procedures for these items are minimal; therefore, you should expect problems with these products to avoi unnecessary and serious problems in your warehousing complex.

Spices. These condiments are known carriers of bacteria, molds, and yeasts. They are nearly nonperishable and can be held in storage for years with little quality deterioration. Yet, the bacterial, mold, or yeast contamination that may be a part of that product may also go undetected for that same period of time. Spices are seen by the general populace as a helpful food additive. Many use spices as a garnish on foods that are already cooked. As you may remember, once a food is cooked, it is vulnerable to these organisms that may be carried by a particular condiment. A foodborne illness outbreak can and has occurred.

Exercises (639):

1. Name the two factors that play a significant role in the probability of loss or deterioration in nonanimal origin subsistence.

2. What is the basic purpose of packaging?

3. What are the factors associated with storage environment that affect a warehousing facility's ability to protect stock?

4. Why is humidity important in the storage environment?

5. What is the most effective and long-term solution for controlling insect and rodent infestation in a warehouse?

6. Why is stock rotation important?

2-3. Packaging, Packing, and Marking

In order for the military user, food inspector, and contractor to keep an accurate picture of the needs for subsistence at a given installation, a marking system has been developed that gives that information to each of the above listed parties. It provides each with detailed information about the product, its contract number, its shelf life, and much more. As a food inspector, you will need to become familiar with this marking system, as well as the kinds of packaging being used, if you are going to be a capable hand in the warehouses at your base.

640. Specify the packaging, packing, and marking system used by the Armed Forces in the subsistence procurement area.

Terminology. Before we cover the subject of packaging, packing, and marking as related to subsistence procurement, we need to spend a short time on some of the terminology associated with the subject. In this objective, we have gathered together the most frequently seen terms related to packaging, packing, and marking. Take a few minutes and go over these terms; become familiar with their meaning, and then proceed.

National stock number (NSN). The NSN for each product authorized for use in Air Force menu planning is listed in a Federal supply catalog. This NSN gives specific information about the produce—i.e., what it must look like, its shape, color, size, the number of pieces per container, and much more. Often, the contract for the particular item will also list the NSN and give a description of the product. No matter where you find the product description that matches the NSN, make sure that the product inside the box meets that description.

Name of product. Again, the manufacturer is required to list the name of the product contained in the box, can, bag, etc. The name listed on the container must be identical to the name used with the NSN assigned to the item.

IMPS. The item, if listed under the Institutional Meat Purchase Specification (IMPS), must be printed on the product's container. Again, this allows you to check the identity of the product in the container against the item description as ordered by the Air Force.

Contract number. The entire contract number must be listed on the container. Again, this gives you a tracking number in case the product is not what the NSN, IMPS, or product name says it is supposed to be.

Grade/selection (if applicable). At times, a particular grade or selection from an animal-origin product is required by the contract, IMPS, or NSN. In such a case, and when specified by the contract, this information will also become a part of the required marking for the container.

Date of pack (DOP). This is the date (month, day, and year) that the product was packed by the manufacturer. It allows for proper rotation of the product while in storage and for the potential extension of the product's shelf life by the food inspector (when necessary). The DOP is used in COLEQUAP, ration inspection, class 5 and class 9 inspections, and any other inspection program where shelf life is needed piece of data.

Lot number. This number indicates the production lot from which the boxed, bagged, or canned product was produced. It is used to identify the product for purposes of warranty action, product recall, or product hold, should such action become necessary. It is foolish to hold an entire day's production when only one lot can be identified as a problem lot. Hence, the lot number.

Net weight. This information is determined by the specification and/or the contract. Under most NSN product descriptions, a specific weight range for each item is outlined. The manufacturer must record this weight range (or net weight) on each container of product produced for the Armed Forces that have constant weights.

Special markings. These include addresses of foreign manufacturers of the specific product (if they have produced the product in the container); subcontractor's addresses, if they actually produce the product and allow it to be distributed by a broker, or such.

Precautionary markings. These are simply notices to the warehouse personnel, and you—the food inspector—that the product requires some form of special handling. Chilled products are often marked as such, with a precautionary marking that reads "Chilled Product. Store at 32° F (0° C) to 38° F (2° C)." Frozen products will also be identified and have precautionary markings that list the suggested storage temperature ranges. You must be aware of these markings when you are inspecting delivered product. If the precautionary marking tells you that the product is a chilled one, and you find the product hard frozen in the container, then you have a problem that requires reporting.

Marking Requirements. Marking on troop issue products must be legible. It has to be conspicuously stencilled, or printed, in letters and numbers not less than ½ inch high. Overseas shipments which require special marking will be marked in letters and numbers that are no less than ¼ inch high. The material used for marking must be flat, waterfast, nonsmearing, and black in color. See Figure 2-2 for an example of the specific marking requirements and their placement.

The contract will always specify a particular packing. This will be identified as a specific packing code such as TPK-1, VS-3, etc. The code is similar in use to an NSN. The technical data sheet attached to each DPSC contract will list these packing codes and explain what they actually mean. In the case of AAFES, you will have to look at the particular contract to determine if there is any specific packing requirements. If there are, then the contract will list the reference source you need to go to to get detailed information; that is all you will need to do. When no specific packing requirements are listed, you need to check for just these few things: First, is the product protected from contamination? Second, will the container adequately hold the product—safeguard it—during storage? Third, is what is inside the container and what the outside marking says it is?

In DPSC procurement, troop issue items are always marked with a cresent moon (fig. 2-3). This identifies the product as having been purchased under DPSC central procurement for use in troop feeding. If the product delivered to you is from a Government warehouse and

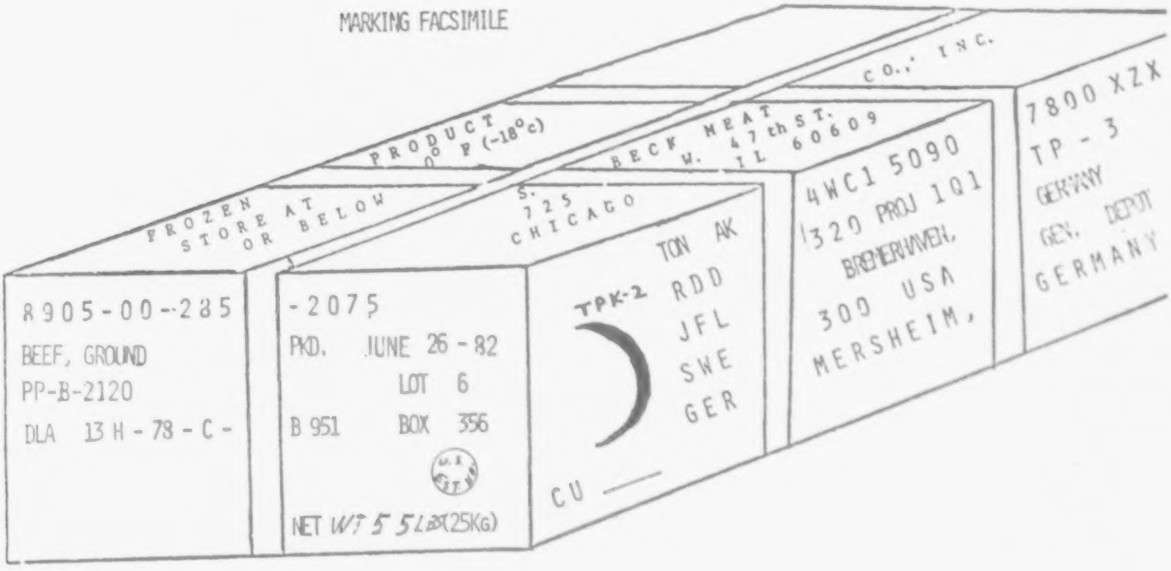


Figure 2-2 Shipping container marking requirements.

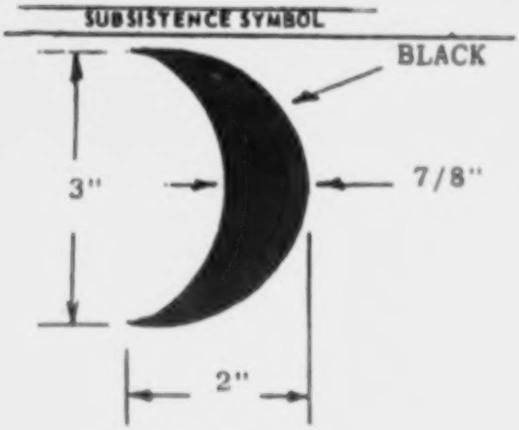


Figure 2-3 DPSC troop issue symbol.

is supposed to be a DPSC-contracted item for troop issue use, it has to have that moon as part of the marking. If the moon is absent, the product is not intended for troop issue.

Exercises (640):

1. What is the purpose of marking the national stock number on a product container?

2. Why is the contract number recorded on the product container?

3. What are the precautionary markings used for?

4. (a) Identify a specific symbol used to designate DPSC troop issue product and (b) explain what you would do if it were not present on a delivered troop issue product.

CHAPTER 3

Procurement of Subsistence

AN ARMY MOVES on its stomach. Have you ever heard that statement before? What does it mean to you? It is meant to imply that when an army is fed well, it functions well. *Food* is a primary factor in the maintenance of morale, as you may well attest from the meals you have eaten in Air Force dining halls in the last months. Though it may not compare to your Mother's apple pie, Air Force food prepared by Air Force food service personnel is the finest that can be had in any of our Armed Forces.

You are part of the system that assures that quality. Here we will cover the procurement system used by the Department of Defense to obtain subsistence for the Armed Forces. We will also discuss the documents that are used to purchase and inspect that food and look at why it is so important for you to understand the procurement system and its terminology.

3-1. Military Procurement System

Three basic systems are used in the Air Force to buy food. These are: (1) the "central" system of the Defense Personnel Support Center (DPSC), (2) the Army-Air Force Exchange Service (AAFES), and (3) the "local" system employed by individual Air Force installations. We will look at these systems here and, also, subsistence procurement, using the "brand name" system of contracting.

641. Distinguish terms concerning the Defense Personnel Support Center (DPSC) central procurement system with relation to selected phrases or definitions.

Central Procurement by the Defense Personnel Support Center (DPSC). Central procurement, or that managed by DPSC, is a great responsibility. You have probably made reference to the DPSC-SIM and the DPSC-SCIPM, but have you actually studied the organization itself? Let's clarify some areas in which DPSC is involved.

DPSC organization. The DPSC, an activity of the Defense Logistics Agency responsible for central procurement of subsistence for the Armed Forces, buys, inspects, stores, and distributes food supplies worldwide for members of the US military forces and their families. The center serves as a link between the food industry and the military consumer. About the only food bought by military organizations for consumption on an installation that is not controlled by DPSC is that procured by the exchanges and clubs and a small number of items which are procured locally.

The Defense Personnel Support Center is a logical evolution from an emergency measure which in 1941 established the Quartermaster Market Center System Program for the procurement of fresh fruits and vegetables for the Army. Adapting the buying practices of the large chain food stores, the program was successful from the start. World War II brought about rapid expansion to include all types of perishable subsistence. This peak wartime organization effectively and efficiently supplied three and one-half billion dollars of perishable foods to all military services at home and overseas each year. It wasn't until 1953 that the QM Market Center system assumed responsibility for the procurement of nonperishable subsistence. This then meant that *all* subsistence procurement was accomplished by informal competitive bidding and by one agency.

The most significant event in the evolution of our Defense Logistics Agency came about in 1956 with the implementation of the single manager plan and the transfer of overall military subsistence supply responsibilities to the newly created Military Subsistence Supply Agency. The single manager plan for subsistence provided, under one roof, most of the tools needed to do the complete job of meeting the subsistence requirements of the US military services worldwide.

The structure of the original Military Supply Agency, created in 1956, is basically the same today. Names have been changed to reflect current Department of Defense thinking. Hence—Defense Supply Agency (DSA) replaced the Military Supply Agency; the single manager plan was replaced by the Defense Personnel Support Center (DPSC). In the most recent change the Defense Supply Agency (DSA) was replaced by the Defense Logistics Agency (DLA).

Before discussing the organization of DPSC further, we must take a brief look at the overall organization of the Department of Defense. The Department of Defense is composed of four elements: the Departments of Army, Navy, Air Force, and the Defense Logistics Agency (DLA). Because the DLA is an equal to the military agencies, and because it is operated for the military, all three branches of the military staff the DLA.

Following the command line, directly under the Defense Logistics Agency we find the Defense Personnel Support Center (DPSC). There are twelve other centers on the same organizational level with DPSC within the Defense Logistics Agency, but we will only concern ourselves with DPSC (fig. 3-1). The Navy has its naval district; the Army, its Army areas; and the Air Force has its major commands such as SAC, TAC, and ATC. The DLA has its commodity managers, which served its commands, Army areas, etc.

The command line stretching below the Defense Per-

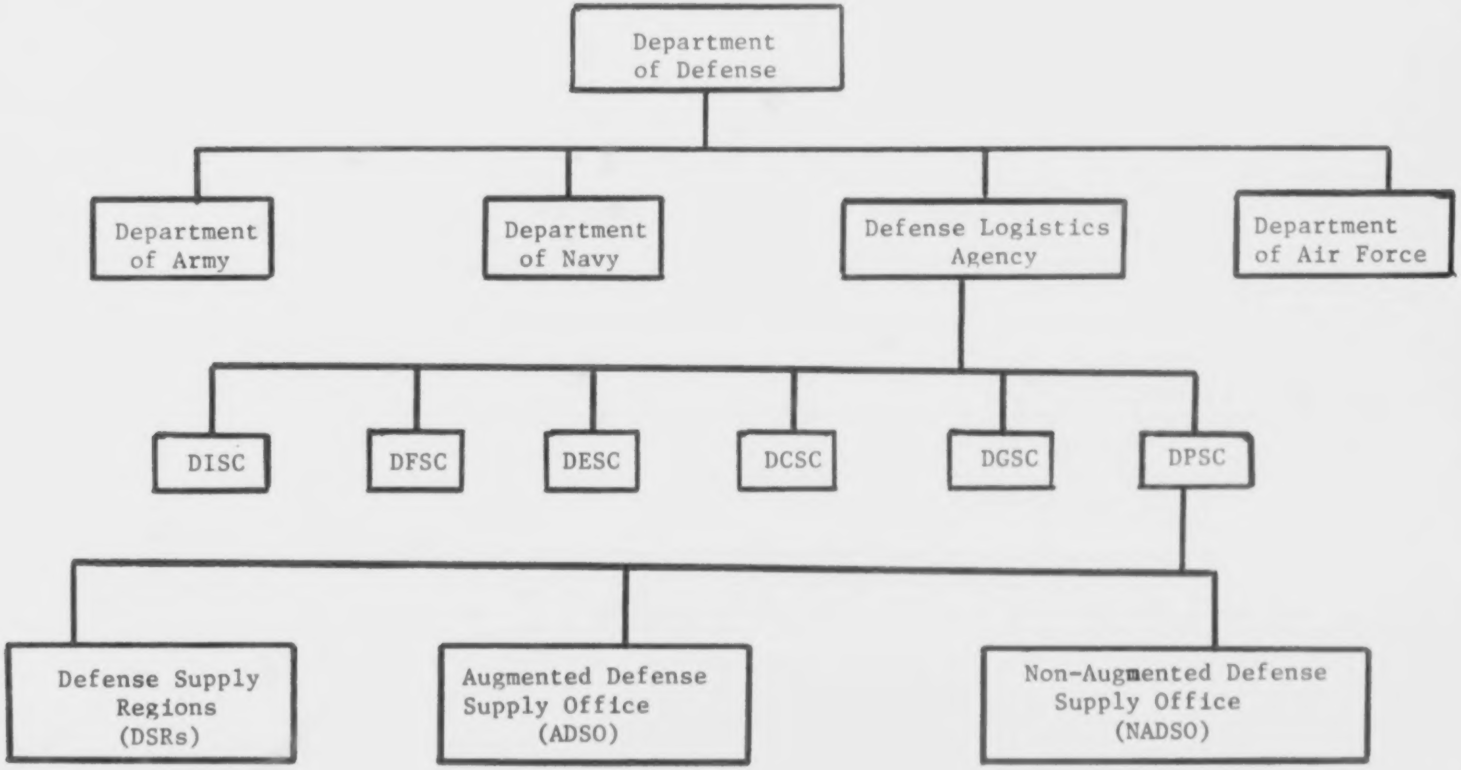


Figure 3-1 Organization of DPSC.

sonnel Support Center (DPSC) connects to the DPSC Subsistence Procuring Elements (SPE). The SPEs include DPSC Defense Supply Regions (DSR); DPSC Augmented Defense Supply Offices, and Nonaugmented Defense Supply Offices (DSO). The SPEs operate under the control of HQ DPSC, but they are located geographically in proximity to food-producing areas, troop concentrations, transportation networks, and ports of embarkation. The responsibilities for the division within DPSC are as follows:

HQ DPSC. Headquarters DPSC is located in Philadelphia, PA. Veterinary officers of the Army work in the Technical and Quality Assurance Division, Directorate of Subsistence (DPSC-ST). Quality assurance specialists are assigned and are directly responsible to the Chief, DPSC-ST. Headquarters DPSC is responsible for controlling and effecting the procurement and inspection of subsistence and for setting policies and procedures for that procurement and inspection. Additionally, HQ DPSC is responsible for the actual procurement of all nonperishable subsistence and all perishable subsistence purchased in more than carlot quantities with a few exceptions, which will be discussed later.

Defense Supply Region (DSR). Presently there are only two defense supply regions. They are the Defense Supply Region (Pacific) and the Defense Supply Region (Europe). These agencies are full procurement agencies, with contract quality assurance specialists which have the authority to purchase perishable subsistence in any quantity. This is one of the exceptions mentioned earlier.

Augmented Defense Supply Offices (DSO). There are five augmented defense supply offices. These are located in Cheatham Annex VA; Chicago IL; Kansas City MO; Fort Worth TX; and New Orleans LA. These offices are responsible for administering contracts written by HQ DPSC and for procurement of perishable subsistence in less than carlot quantities. The one exception to this is that the Augmented Defense Supply Office located in New Orleans LA is authorized to purchase seafood in the southeastern US in any quantity. The offices are augmented with quality assurance specialists to assist you with any problem that you may have with a contract administered by that office.

Nonaugmented Defense Supply Offices (DSO). These offices are located throughout the United States. They are not augmented with quality assurance specialists and are primarily responsible for warehousing of DPSC-owned subsistence. However, some do have the responsibility for field and street buying of fresh fruits and vegetables, and the DSO in Boston MA has the responsibility for procurement of seafood in the New England area.

Two important points to remember are that HQ DPSC does not write or administer all contracts and that you must contact the Contract Quality Assurance Element at the agency responsible for administering the contract for any assistance that you might need.

Exercises (641):

1. Match each item on the DPSC central procurement system in column B with its related phrase/definition in column A. Terms may be used once or more than once:

Column A	*Column B*
___ (1) A link between the military consumer and the food industry.	a. DLA.
___ (2) An activity within the DLA.	b. Military Subsistence Supply.
___ (3) Single manager plan (1956).	c. SPE.
___ (4) Replaced DSA.	d. DPSC.
___ (5) One of four equal elements within the DOD.	e. DSO.
___ (6) Located geographically in proximity to food-producing areas.	f. DSR.
___ (7) Administer contracts procuring perishable subsistence in less than carlot quantities.	
___ (8) Full procurement agencies for perishable items.	

642. Resolve the validity of given statements concerning DPSC activities.

DPSC Activities. The Defense Personnel Support Center (DPSC) is a commodity management and service center of the DLA which has responsibility for procuring, inspecting, storing, and distributing subsistence, clothing and textiles, and medical supplies for the DOD. Environmental Health personnel are primarily interested in subsistence. To perform the subsistence inspection mission, there are HQ DPSC and the SPEs. Any reference hereafter to HQ DPSC or of the SPEs should be understood to be related to subsistence.

DPSC procures $1.2 billion of the $1.5 billion spent annually for food for the Armed Forces. The remaining $300 million is spent chiefly on local purchases of fresh fruits and vegetables in overseas areas and for brand name items procured for use in CONUS. Expenditures average $3 million each working day, cover a range of 1,205 food items in the subsistence catalogue, and result in 189,000 contracts annually to 3,500 suppliers. These figures exclude brand name purchases. Inventories of subsistence in storage range from $175 to $200 million. The DPSC's activities may be compared to the wholesale phase of a national food chain operation. It has purchasing offices in specified regions covering the entire country, and these serve as distribution points for perishable subsistence.

Whether it is fresh foods, frozen foods, canned foods, dehydrated foods, operational rations, or survival rations the Defense Personnel Support Center probably purchases it. In fulfilling this responsibility, the DPSC does business with all segments of the food industry. Perishable and nonperishable foods are procured by HQ DPSC. The following paragraphs explain how it is done.

Nonperishable items. All nonperishable subsistence is purchased by HQ DPSC. Request for proposals (RFPs) or invitations for bid (IFBs) are sent to all vendors in the United States who are approved to sell the item desired to the DOD. These RFPs and IFBs include all of the necessary information required by the vendor to determine the amount of money each must bid in that vendor's efforts to sell to the government; i.e., specifications, quantities, business management restrictions, delivery dates, etc. When each vendor's bid has been received, the procuring contracting officer (PCO) will award the contract to the vendor who has submitted the lowest bid. The system used to procure nonperishable subsistence is rather formal and rigid in comparison to the ways perishable foods are bought.

Perishable items. Solicitation of offers is by means of a master solicitation, annexes (perishables only), Requests for Proposals (RFPs), or invitations for bid (IFBs), which list the item, pertinent specifications, quantities, destinations, delivery dates, and time of closing. These solicitations are sent nationwide to all qualified suppliers who have indicated an interest in bidding on military requirements. The supplier submits that vendor's offer oral or written, to the nearest SPE or to the SPE specified in the notice of intent to purchase. All details concerning the offers are immediately recorded and are compared to determine which offer or combination of offers represents the best value to the Government.

When a carload or truckload quantity of perishable subsistence is involved, the lowest offer, representing the best value on a nationwide basis, is determined. Instructions are then issued to the appropriate SPE to make the award and administer the contract. Less than carload or truckload requirements are normally procured by the individual SPE from suppliers located within its distributing area. This typical procedure is varied in "street and field purchasing" of fresh fruits and vegetables. Under "street and field purchasing" procedures, skilled purchasing agents visit the growing areas for carload requirements or the terminal market for less-than-carlot quantities, where the best value in produce offered is determined and an award is made at the local level.

Brand name items. Indefinite delivery type contracts are also used, when appropriate. Purchase notice agreements (PNAs), a form of this type of contract, are made for brand name resale items, and are published by DPSC in Defense Logistics Agency Purchase Notice Agreement Supply Bulletins for the use of all Government activities.

Storage and Distribution. The principle that the customer establishes the demand applies to DPSC operations in the same way it does in the civilian world. DPSC buys, stores, and distributes only what its customers want, and these wants are reflected in the requisitions submitted by the customers.

Requirements for perishable subsistence are determined by the SPEs or by HQ DPSC (where the DSR had been phased out) on the basis of monthly requisitions by the consuming installations. Supply support is provided through government or commercially operated storage and distribution points to which carlot purchases are delivered for subsequent breakdown and delivery to individual installations on an average of three times per week.

The Defense Personnel Support Center has agreements for cold storage service on an "as required" basis with commercial refrigerated warehouses located throughout the country. These agreements are used for the storage of frozen items, for long-term storage of combat-type rations, and for potential expansion in the event of mobilization. DPSC monitors the Department of Defense Commercial Warehouse Service Plan for refrigerated space and services required by any military departments.

In the case of nonperishables, Headquarters DPSC computes the military services' replenishment requirements for depot—stocked items and prepares the necessary procurement requests. The supplies received from procurement are placed in depots in the continental United States or overseas in the balanced stock quantities needed to meet monthly requirements of consuming bases, posts, camps, stations, and overseas commands. Direct-vendor delivery to the consumer or to a port for overseas shipment is utilized wherever possible when economical shipping quantities are involved.

Food inspectors report all nonconformances on DPSC contracts to the contract quality assurance element supporting the SPE. Reporting procedures are outlined in DPSCM 4155.6.

Defense contract administration service (DCAS). The DCAS is concerned with the administration of nonfood ration component contracts after DPSC has awarded the contracts and preaward surveys of food plants prior to award of contracts to insure that the plant is capable of producing the product which is contracted.

Exercises (642):

If each statement of DPSC activities in items 1 through 7 is correct, mark it true (T); if any is false, mark it false (F), and correct it:

T F 1. Vendors submitting the highest bids will be awarded the contract by the PCO.

T F 2. HQ DPSC purchases all perishable subsistence.

T F 3. All vendors approved to sell the subsistence item are provided appropriate RFPS and IFBS on the specific products.

T F 4. The procuring contracting officer (PCO) will award the contract to the vendor who can most completely comply with product specifications.

T F 5. Requirements for perishable subsistence are determined by the SPEs on the basis of yearly requisitions by the consuming installations.

T F 6. Defense Contract Administration Service is concerned with the administration of nonfood rations.

T F 7. Food inspectors will report all nonconformances on DPSC contracts to the contracting officer, DPSC Headquarters.

643. Identify valid procedures used in local, brand name, and AAFES procurement.

Local Procurement. An additional procurement system, local procurement,is also available for use by the commissary officer. Local procurement involves the purchase of items by a local base purchasing and contracting office (P&C office) for resale through the commissary sales store or for troop issue. It is the purchase of any item by a single base to meet the demands of that installation's consumers (as opposed to central procurement by SPEs serving many bases).

When local procurement is used, it is important that the base environmental health officer become involved as the quality assurance representative. Most base P&C offices are not familiar with the food items they procure so the base Environmental Health Service should offer technical assistance as to the quality requirements needed to protect the financial interests of the Government. It is desirable that all local procurement documents pertaining to food items be reviewed by the base Environmental Health Service prior to the issuance of purchase orders or contracts. This could prevent the Air Force from having to accept a product that it does not really want or need, simply because there was a lack of communication, and the correct product requirements were not specified.

Many locally procured items are bought by use of documents known as blanket purchase agreements (BPAs) as we have said earlier. In using the BPA, the P&C officer authorizes the commissary to buy a specified item (or items) from a given company for a stated period of time, usually 30 days. At the end of that time, the commissary totals the quantities received and payment is made by the base accounting and finance office. A BPA may or may not include quality requirements for the items listed.

In addition to using the BPA system of ordering a product, the base P&C office may use a contract. Formal local contracts will usually be issued for deliveries over an extended period of time. The role of the base Environmental Health Service in the review of these contracts is also important, as most of these contracts are for items bought in large quantities at large cost.

The P&C office will administer the BPA or contract, but it will usually delegate the authority to order, receive, or reject the product to the commissary officer. Normally, recommendations for rejection of locally procured items should be made to the commissary officer. The P&C officer should also be made aware of the nonconformance, so that it may be entered in the vendor's history file. If an occasion should arise when the commissary officer loses sight of the best interests of the Government and accepts a product that may result in a severe problem at a later date, the P&C officer should be notified immediately.The P&C officer may override the decision of the commissary officer. This course of action should be followed only upon the direct instructions of the OIC or NCOIC, as it may well cause poor relations between the environmental health office and the commissary office.

Many of the items upon which you conduct a class 4 inspection (to be discussed later) at base level will be procured locally. It is imperative for you to know whether the item is procured through central or local procurement, so that recommendations pertaining to acceptance/rejection may be made with a minimum of confusion.

Brand Name Procurement. Many items purchased with either appropriated or nonappropriated funds are bought on a "brand name" basis. Procurement by brand name is simply buying the item(s) by brand or trade name without reference to specifications. The producer/processor/manufacturer determines the quality standards for the product in keeping with the company's own quality standards.

Brand name procurement may be used in any of the procurement systems previously mentioned. DPSC buys great quantities of brand name items for resale through the commissary store, and the commissary officer may also buy brand name items through local P&C offices. DPSC publishes a document, DPSC Supply Bulletin 10-500, which lists the companies (also the items and their unit prices) with whom DPSC has standing contracts for name brand purchases. In order for a vendor to qualify for listing in SB 10-500, the vendor must have a recurring customer demand with at least 25 separate commissary stores.

The commissary officer may procure brand name items (other than those listed in SB 10-500) under brand name procedures based upon customer preference and recurring customer demand at his store. Many items that are produced in the local area may be purchased in this manner.

As stated earlier, the quality standards for brand name items are established by the vendor. As a result, the inspection of the product for quality is not required for determining contract conformance. Inspection of the product for condition and identity must be made along with examination for net weight/volume. Examinations for quality may be important in some instances, as they may indicate that the quality of the particular brand name is not worth the price that is being paid. Even then, the poor quality is not a basis for recommending rejection but only for recommending that another source of supply be obtained.

Central Procurement by the Army and Air Force Exchange System. Many of the items procured with nonappropriated funds (NAF) are bought by the Army and Air Force Exchange System (AAFES). AAFES is divided into exchange regions (ERs), with headquarters on either an Army post or an Air Force base. Each ER is provided with the services of a military veterinarian to provide technical assistance to the bases within that region. This organization and the accompanying responsibilities are further explained in ESM 1-2, "Veterinary and Preventive Medicine Services." (fig. 3-2.)

The requirements of the exchange facilities of an individual installation are forwarded to the regional headquarters, which issues the purchase order (PO). It is very important that the Base Environmental Health Service of the receiving installation be provided a copy of the PO, as it is the only document which references the AAFES stock number for that item. Without the stock number, the product cannot be identified in ESM 25-1 "Food and Supplies," the document which contains the inspection requirements for AAFES-procured products.

Nonconformances found upon inspection of a product procured by AAFES should be reported in accordance with ESM 1-2, which requires notifying the facility manager and submitting to that manager copies of AAFES Form 6500-20, Subsistence Inspection Report.

Most of the items procured by AAFES will be subject to procurement inspection at the receiving installation. A thorough knowledge of ESM 1-2 and the availability

AAFES PROCUREMENT

Base Exchange Food Facility	- Receives the food from the vendor - Has acceptance and rejection authority - Completes AAFES Form 6500-20 sent by the Environmental Health food inspection office - Organizes delivery schedule with the vendor
Environmental Health Office	- Inspects the food being purchased by the exchange facility - Recommends acceptance or rejection - Initiates AAFES Form 6500-20 on items recommended for rejection - Forwards completed AAFES Form 6500-20 to Exchange Region
Exchange Region	- Coordinates Environmental Health inspection activities - Advises AAFES on procurement requirements - Maintains vendor history records

Figure 3-2 Organizational relations in AAFES subsistence procurement and inspection.

of a current copy of ESM 25-1 is imperative if the base Environmental Health Service is to provide the detailed inspection necessary to protect the financial interests of the AAFES consumer.

Exercises (643):

Mark each statement on local, brand name, or AAFES procurement in exercises 1 to 6 true (T) or false (F) based on materials presented in objective 643; correct each false statement.

T F 1. The commissary may not utilize local procurement.

T F 2. The quality assurance representive for local procurement is the base P&C officer.

T F 3. Locally procured items are purchased on an RFP.

T F 4. All items procured "brand name" must appear on DPSC Supply Bulletin 10-400.

T F 5. All nonconformances noted on AAFES-procured items will be reported on AAFES Form 6500-20.

T F 6. Commissary officers may purchase items locally by brand name to provide for consumer preferences.

3-2. Contracting for Subsistence

The importance of inspection documents cannot be overemphasized. One can be the best observed but have a lack of understanding of what constitutes inspection documents or their interpretation and he will consequently fail as an inspector. Interpretation of contract documents is no harder than the understanding or completion of forms you were faced with in civilian life; e.g., driver's license, insurance, and school examination forms.

644. Describe subsistence procurement documents by identifying the nature, content, or function.

Contracts. Contracts (purchase orders) are used for the procurement of subsistence. At times, these contracts may include references to other documents (thereby making them a part of the contract) or they may have other documents attached. Collectively, the contract and the referenced or attached documents are referred to as "purchase instruments." Information on the contract or purchase order takes precedence over any other referenced material.

To inspect anything, you must have written legal standards which tell you the acceptable quality, composition, allowable limits of undesirable properties or contaminants, packaging and marking required, and handling procedures for the items to be examined. Without these guidelines you have *no* legal basis for inspection. All of us are familiar with contracts in some form.

If you agree to buy your friend's car, you and your friend have made a contract. When a man and woman get married, each agrees to do (or not do) certain things. They have agreed upon a contract of marriage. Thus, a contract is an agreement between two or more people to do something. When you enlisted, you signed a contract.

A contract is also a written agreement between the Government and a commercial company for the government to purchase a commodity; for example, pork roasts and pork slices, boned, frozen. Two examples of contracts are DPSC Form 300, Order for Subsistence, and DPSC Form 300-1, Order for Subsistence Continuation Sheet. In some special instances orders may also be placed on DD Form 1155, Order for Supplies or Services, Request for Quotations.

The terms of the contract—e.g., price, quantity, delivery and inspection statements, referenced product description, documents and referenced administrative requirements—are all binding on the parties entering into the contract. Each contract that is written will contain specific information that is of importance to he inspector. Without this information, an inspector cannot adequately inspect a product.

Most of the inspection requirements and documents which must be used to perform inspections are referenced in the master solicitation, annexes (if any), and changes to the annexes. Some contracts do not cite a solicitation. In these cases the contract itself will list all required documents or information that must be used by the inspector.

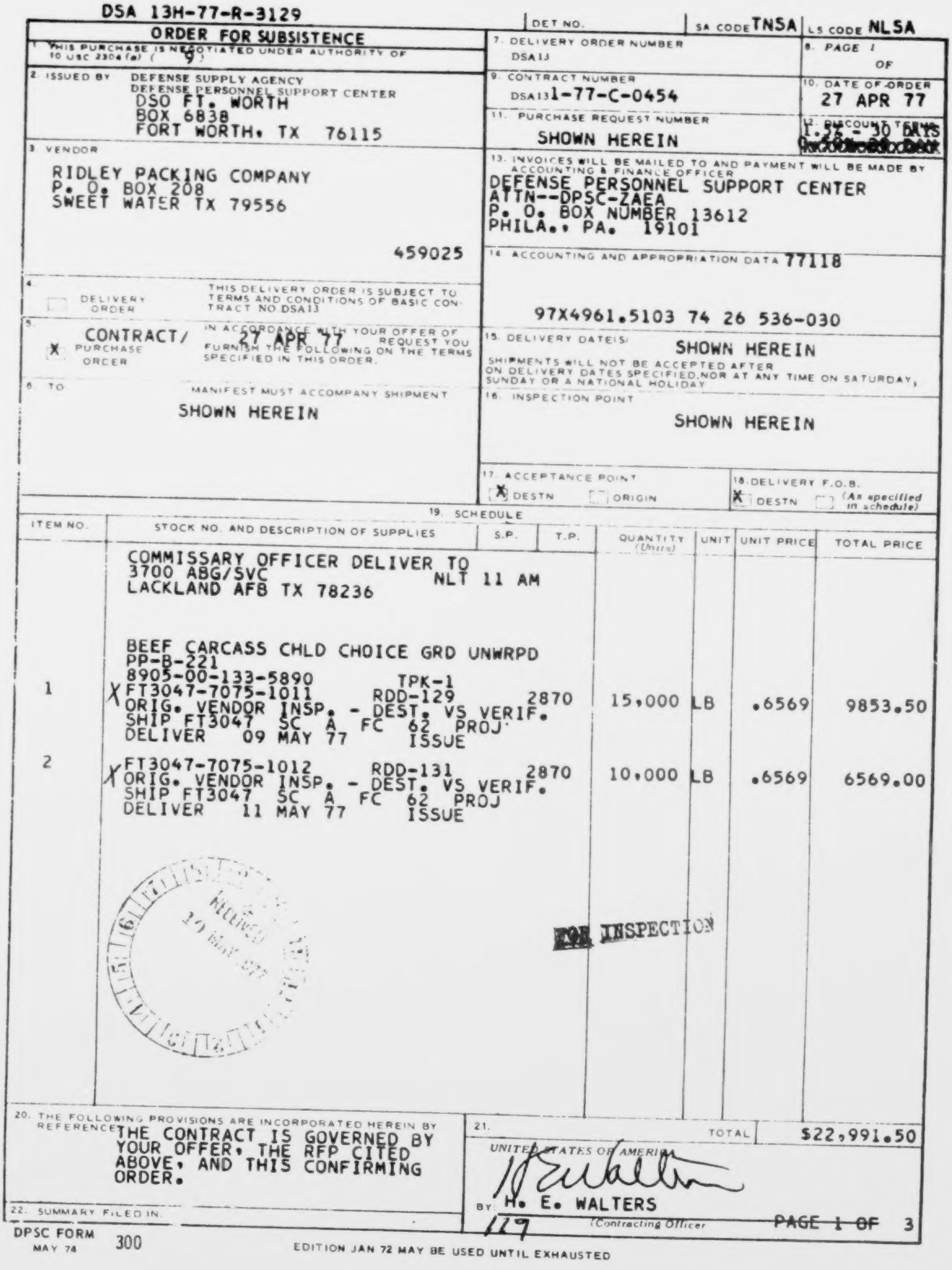
Refer now to DPSC Forms 300 and 300-1 (figs. 3-3 and 3-4) and note the following items (not all items concern us here):

a. Item 2 (Issued by) gives the DPSC SPE that issued the contract. The contract quality assurance element at that SPE will act as liaison between you, the inspector, and the procuring contract officer (PCO).

*b.*Item 3 (Vendor) lets you know to whom the contract was awarded.

c. Item 6 (T.) tells you the destination points that will receive the commodity.

d. Item 9 lists the contract number (purchase instrument identification number). When reporting inspection results, this number is always referenced. The first 3 digits identify the DPSC headquarters that issued the



DSA 13H-77-R-3129

DET NO. | SA CODE TNSA | LS CODE NLSA

ORDER FOR SUBSISTENCE

1. THIS PURCHASE IS NEGOTIATED UNDER AUTHORITY OF 10 USC 2304 (a) (9)

2. ISSUED BY
DEFENSE SUPPLY AGENCY
DEFENSE PERSONNEL SUPPORT CENTER
DSO FT. WORTH
BOX 6838
FORT WORTH, TX 76115

3. VENDOR
RIDLEY PACKING COMPANY
P. O. BOX 208
SWEET WATER TX 79556
459025

4. ☐ DELIVERY ORDER — THIS DELIVERY ORDER IS SUBJECT TO TERMS AND CONDITIONS OF BASIC CONTRACT NO DSA13

5. ☒ CONTRACT/PURCHASE ORDER — IN ACCORDANCE WITH YOUR OFFER OF 27 APR 77 REQUEST YOU FURNISH THE FOLLOWING ON THE TERMS SPECIFIED IN THIS ORDER.

6. TO — MANIFEST MUST ACCOMPANY SHIPMENT
SHOWN HEREIN

7. DELIVERY ORDER NUMBER
DSA13

8. PAGE 1 OF

9. CONTRACT NUMBER
DSA131-77-C-0454

10. DATE OF ORDER
27 APR 77

11. PURCHASE REQUEST NUMBER
SHOWN HEREIN

12. DISCOUNT TERMS
1.5% - 30 DAYS

13. INVOICES WILL BE MAILED TO AND PAYMENT WILL BE MADE BY ACCOUNTING & FINANCE OFFICER
DEFENSE PERSONNEL SUPPORT CENTER
ATTN--DPSC-ZAEA
P. O. BOX NUMBER 13612
PHILA., PA. 19101

14. ACCOUNTING AND APPROPRIATION DATA 77118
97X4961.5103 74 26 536-030

15. DELIVERY DATE(S) SHOWN HEREIN
SHIPMENTS WILL NOT BE ACCEPTED AFTER ON DELIVERY DATES SPECIFIED,NOR AT ANY TIME ON SATURDAY, SUNDAY OR A NATIONAL HOLIDAY

16. INSPECTION POINT
SHOWN HEREIN

17. ACCEPTANCE POINT ☒ DESTN ☐ ORIGIN

18. DELIVERY F.O.B. ☒ DESTN ☐ (As specified in schedule)

19. SCHEDULE

ITEM NO.	STOCK NO. AND DESCRIPTION OF SUPPLIES	S.P.	T.P.	QUANTITY (Units)	UNIT	UNIT PRICE	TOTAL PRICE
	COMMISSARY OFFICER DELIVER TO 3700 ABG/SVC NLT 11 AM LACKLAND AFB TX 78236						
	BEEF CARCASS CHLD CHOICE GRD UNWRPD PP-B-221 8905-00-133-5890 TPK-1						
1	X FT3047-7075-1011 RDD-129 ORIG. VENDOR INSP. - DEST. VS VERIF. SHIP FT3047 SC A FC 62 PROJ DELIVER 09 MAY 77 ISSUE	2870		15,000	LB	.6569	9853.50
2	X FT3047-7075-1012 RDD-131 ORIG. VENDOR INSP. - DEST. VS VERIF. SHIP FT3047 SC A FC 62 PROJ DELIVER 11 MAY 77 ISSUE	2870		10,000	LB	.6569	6569.00

FOR INSPECTION

20. THE FOLLOWING PROVISIONS ARE INCORPORATED HEREIN BY REFERENCE THE CONTRACT IS GOVERNED BY YOUR OFFER, THE RFP CITED ABOVE, AND THIS CONFIRMING ORDER.

21. TOTAL $22,991.50

UNITED STATES OF AMERICA
H E Walters
BY: H. E. WALTERS
129 (Contracting Officer

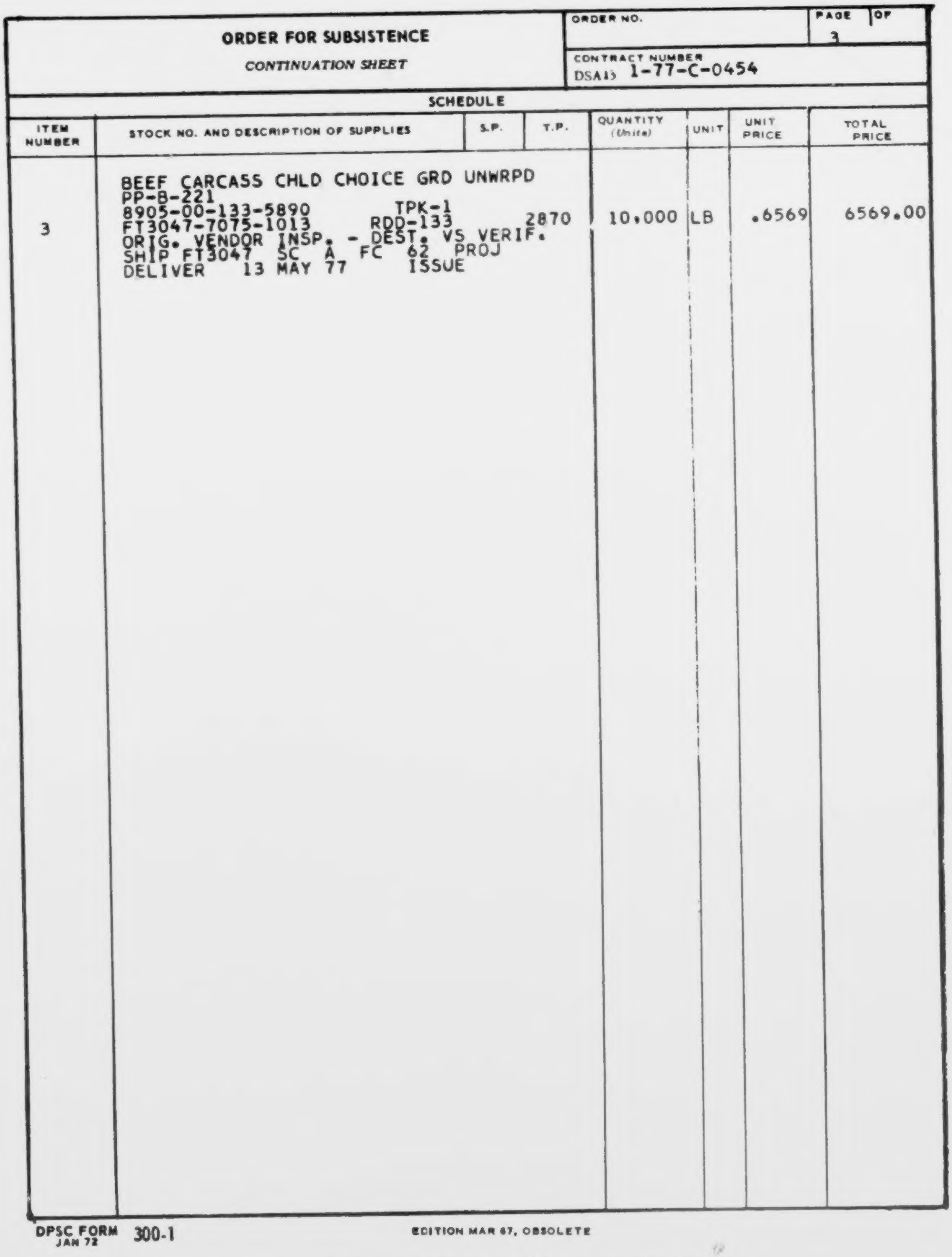
~~PAGE 1 OF~~ 3

22. SUMMARY FILED IN

DPSC FORM 300
MAY 74

EDITION JAN 72 MAY BE USED UNTIL EXHAUSTED

Figure 3-3 Sample of DPSC Form 300.



ORDER FOR SUBSISTENCE

CONTINUATION SHEET

ORDER NO.

PAGE 3 OF

CONTRACT NUMBER DSA13 1-77-C-0454

SCHEDULE

ITEM NUMBER	STOCK NO. AND DESCRIPTION OF SUPPLIES	S.P.	T.P.	QUANTITY (Units)	UNIT	UNIT PRICE	TOTAL PRICE
3	BEEF CARCASS CHLD CHOICE GRD UNWRPD PP-B-221 8905-00-133-5890 TPK-1 FT3047-7075-1013 RDD-133 ORIG. VENDOR INSP. - DEST. VS VERIF. SHIP FT3047 SC A FC 62 PROJ DELIVER 13 MAY 77 ISSUE		2870	10,000	LB	.6569	6569.00

DPSC FORM 300-1
JAN 72

EDITION MAR 67, OBSOLETE

Figure 3-4 Sample of DPSC Form 300-1 continuation sheet

contract—e.g., "131" for Fort Worth Augmented Defense Supply Office. The next two digits refer to the fiscal year the contract was issued. The following letter identifies the method of requisitioning or ordering that was used—e.g., M – manual, C – computer or MILSTRIP ordering. The last 4 digits are the most important part of the contract number to you as they identify the specific contract action.

e. Item 15 (Delivery Dates) tells you the date the product is to be delivered.

f. Item 16 (Inspection Point) states the type of inspection that must be used on the product—e.g., origin vendor/vs verfication.

g. Items 17—(Acceptance Point) and 18—(Delivery F.D.B.) indicate the inspection and acceptance points of the product and who will pay the delivery charges.

i. Item 19 (Schedule) lists the specific items that are to be procured and inspected—e.g., beef carcass, chilled, choice, graded, unwrapped. The level of packaging and packing protection usually will be found here—e.g., packaging and packing level B of the commodity specification. There are several sets of numbers listed in this part of the contract for each of the award line items to be produced. Each commodity procured for the armed services, except new items and most brand name items, has an identifying number listed in the 8900 series. This is known as the "national stock number" and is listed in the schedule.

The Quantity Unit of Purchase, Unit Price, and Total Price sections of the Schedule tell you how many pounds, slices, boxes, etc., are to be produced and their unit and total price. These are listed separately for each line item that is listed in the contract.

Note that the same type of information listed in the schedule is also listed for added line items on the continuation sheet, DPSC Form 3000-1.

i. Item 20 lists several clauses and forms that are contractual. Much information in each of these documents does not apply to the inspection of the product. Some of the items do cite inspection or produce requirements, however, so you must read each document carefully to be sure that you are inspecting the commodities properly for the correct features or characteristics.

When nonperishable foods with a value of more than $10,000 per item are procured, a different contract form is normally used. This is the Award/Contract, SF 26 and SF 36. figs. 3-5 and 3-6. These products usually require origin inspection so the contract cover sheet will list those activities responsible for the inspection. This type of contract will always require the use of the referenced RFP or IFB to determine inspection requirements.

Now that you have a basic idea of what information contracts include and how they are used, let us consider the referenced documents.

The Master Solicitation. This is a booklet of solicitation terms, conditions, and instructions, and contract clauses which have applicability to all or a great percentage of subsistence procurements. Where applicability is limited, the clause itself will so state. Contractors and potential suppliers are cautioned to retain the Master Solicitation, since it is normally issued only once a year. This document is distributed to units having inspection responsibility for a approved suppliers. Most of the contract provisions as a general nature are included in the Master Solicitation. Information concerning preservation, packing and packaging, sanitary condition of vehicles, warranty clause provisions and marking requirements may all be found in the Master Solicitation. Also listed in this publication is a list of referenced documents that apply.

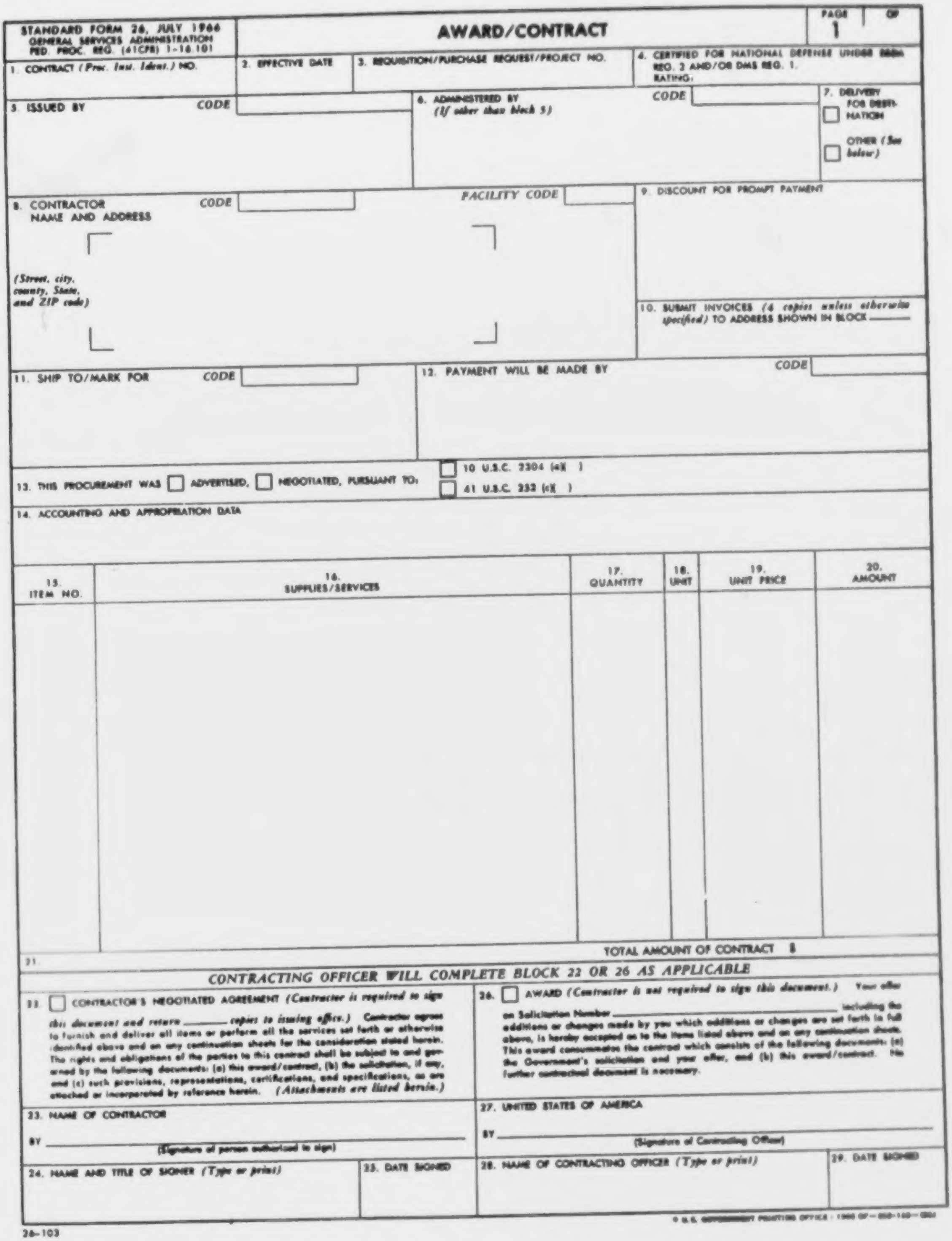
Product Annex. As we have stated previously, the Master Solicitation contains information of a general nature and is not commodity oriented. The product annexes are commodity oriented and contain item descriptions and technical material oriented to a particular commodity. The product annex is issued in conjunction with the Master Solicitation to cover the specific product requirements, and each annex has a specific number. Product annexes may be used to make changes to be cited specification. Also contained in the product annex is the variation in quantity information and a list of referenced documents that will apply. The applicable product annex will be referenced in the request for proposal or invitation for bid by its specific number.

The product annex takes its place between the Master Solicitation and the product specification, which we will discuss in just a moment. The annex takes the reader past the generalized language of the Master Solicitation and provides commodity, or general, product descriptions. Here's an example: the Master Solicitation for bread and bakery products discusses general information about the requirements for all bread and/or bakery products. The product annex will discuss the requirements for whole loaf bread, sliced bread, rolls, wrapped bread, unwrapped bread, etc. When you need more detailed information about a particular bread item—whole wheat, sliced, 21-ounce loaf—you would have to go to that specific product's specification. The product annex is the intermediate item description document.

Request for Proposal. The request for proposal (RFP) is the written notice to the food industry that a specific product is to be purchased and that DPSC requests bids from individual companies to produce the product. The RFP contains a listing of the product(s) to be purchased, packing levels, and special shipping instructions. The RFP also contains the documents that will apply, such as the Master Solicitation, product annex, and DPSC articles and clauses.

Invitations for Bid (IFBs). The IFB is another kind of notice to the food industry. It serves much the same purpose as an RFP in that it advises potential suppliers that certain products will be purchased and invites their bids. IFBs are considerably more formal than RFPs, since little negotiation between contracting officials and bidders is authorized. This form of advertisement is used primarily on nonperishable, nonanimal subsistence involving purchases of more than $10,000.

Specifications. These documents give a clear, accurate, and detailed description of product requirements. For example, if we were inspecting "Hamburger,



STANDARD FORM 26, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41CFR) 1-16.101

AWARD/CONTRACT

PAGE 1 OF

1. CONTRACT (*Proc. Inst. Ident.*) NO.

2. EFFECTIVE DATE

3. REQUISITION/PURCHASE REQUEST/PROJECT NO.

4. CERTIFIED FOR NATIONAL DEFENSE UNDER BDSA REG. 2 AND/OR DMS REG. 1.
RATING:

5. ISSUED BY CODE

6. ADMINISTERED BY (*If other than block 5*) CODE

7. DELIVERY
☐ FOR DESTINATION
☐ OTHER (*See below*)

8. CONTRACTOR CODE FACILITY CODE
NAME AND ADDRESS
(*Street, city, county, State, and ZIP code*)

9. DISCOUNT FOR PROMPT PAYMENT

10. SUBMIT INVOICES (*4 copies unless otherwise specified*) TO ADDRESS SHOWN IN BLOCK ______

11. SHIP TO/MARK FOR CODE

12. PAYMENT WILL BE MADE BY CODE

13. THIS PROCUREMENT WAS ☐ ADVERTISED, ☐ NEGOTIATED, PURSUANT TO: ☐ 10 U.S.C. 2304 (a)( ) ☐ 41 U.S.C. 252 (c)( )

14. ACCOUNTING AND APPROPRIATION DATA

15. ITEM NO.	16. SUPPLIES/SERVICES	17. QUANTITY	18. UNIT	19. UNIT PRICE	20. AMOUNT

TOTAL AMOUNT OF CONTRACT $

21.

CONTRACTING OFFICER WILL COMPLETE BLOCK 22 OR 26 AS APPLICABLE

22. ☐ CONTRACTOR'S NEGOTIATED AGREEMENT (*Contractor is required to sign this document and return ______ copies to issuing office.*) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. (*Attachments are listed herein.*)

26. ☐ AWARD (*Contractor is not required to sign this document.*) Your offer on Solicitation Number ______________ including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

23. NAME OF CONTRACTOR
BY ______________
(Signature of person authorized to sign)

27. UNITED STATES OF AMERICA
BY ______________
(Signature of Contracting Officer)

24. NAME AND TITLE OF SIGNER (*Type or print*)

25. DATE SIGNED

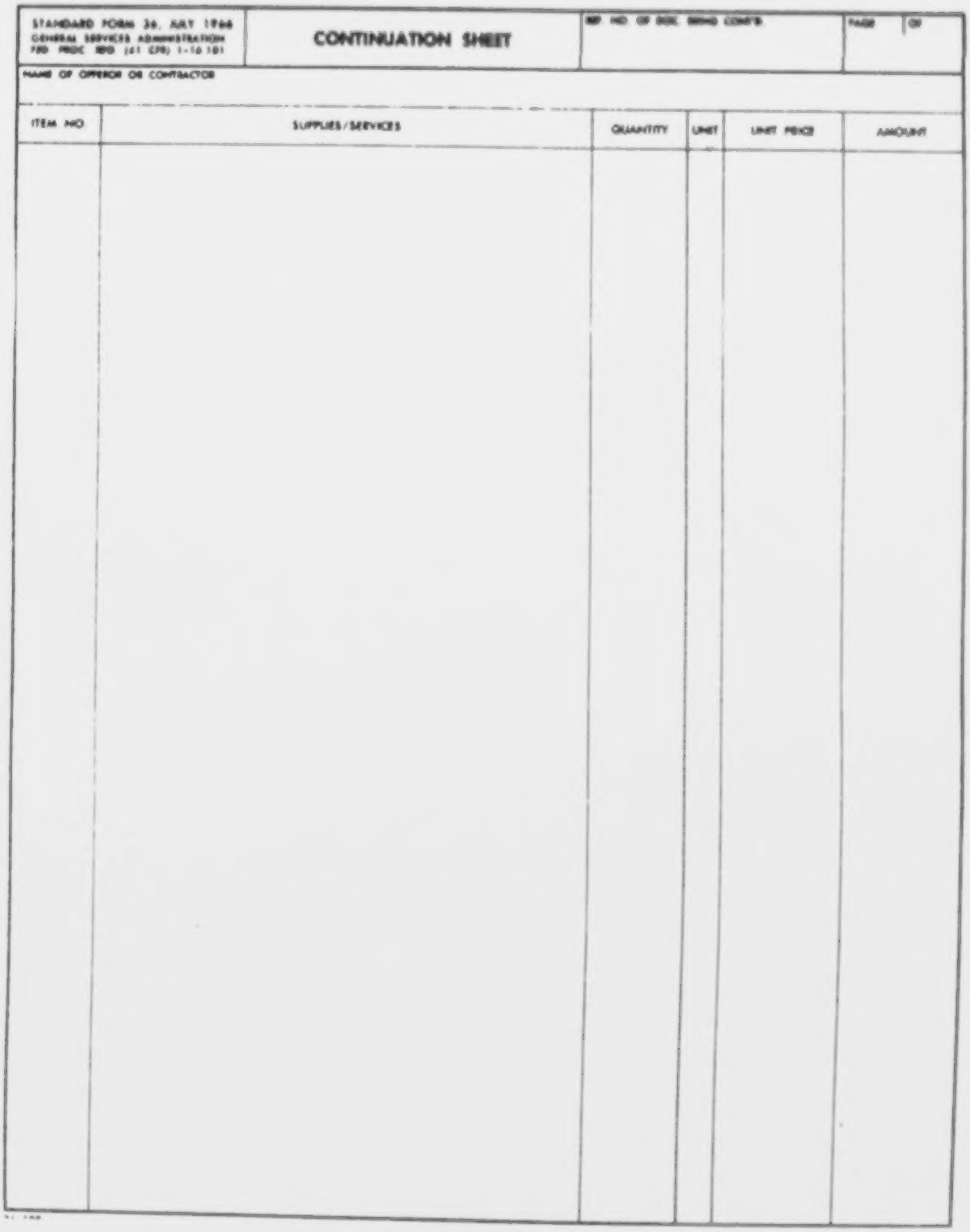
28. NAME OF CONTRACTING OFFICER (*Type or print*)

29. DATE SIGNED

U.S. GOVERNMENT PRINTING OFFICE : [illegible]

26-103

Figure 3-5 Standard Form 26.



STANDARD FORM 36, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

CONTINUATION SHEET

REF. NO. OF DOC. BEING CONT'D

PAGE OF

NAME OF OFFEROR OR CONTRACTOR

ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT

Figure 3-6 Standard Form 36, continuation sheet.

Canned," we would have at hand the specifications for that product. If we were inspecting canned pork and beans, we would need that product specification. How much pork do you imagine there must be in each can? A little piece? Just a dab? No, these terms don't tell us very much. In contrast, the specification tells us (specifies) exactly how much pork is required. In our pork and beans example, there would be many other requirements, such as time and temperature for processing, size of the can, net weight of the contents of each can, and many other detailed requirements. What you must realize is that it is impossible to inspect a product properly unless you have, and are familiar with, the specification. There are two types of specifications and several other documents that may modify them.

Federal specifications. These documents are in a Federal series as opposed to a military series, because of the declared interest by a civil agency (HEW/USDA/VA, etc.) in the item(s) described by the specification. When civil agency interest is declared on an item described by a military specification, the military specification will be converted to the Federal series. Federal specifications are used in the procurement of products corresponding to those normally produced commercially.

Military specifications. These are developed for items used predominately by the military. They incorporate requirements for longer storage periods, rougher handling, and field use, such as operational rations.

Amendments. Amendments are changes to specifications used to correct printing errors, modify procedures, and generally keep the specifications up-to-date.

Purchase descriptions or interim specifications. These are proposed "new item" specifications. They are used on a trial basis and will either be adopted as specifications or dropped.

Parts of a specification.Regardless of whether a particular specification is military or Federal, the basic format is the same, with each specification being divided into six parts or sections.

Section 1. This is *Scope.* This section explains what the product is and defines such terms as "class," "type," "form," and "style." With different products, the meaning of these terms may vary, but by reading the Scope, the inspector can determine the product to be inspected and the specific usage of the terms.

Section 2. This is *Applicable Documents.* This section provides the inspector with a listing of other documents that also contain requirements relevant to the product. These documents become contractual by being referenced in the Specification.

Section 3. This is *Requirements.* This section provides specific requirements for the product. An example would be, for ground beef, that "the fat element shall not be more than 22 percent." This section may also list requirements pertaining to processing the item.

Section 4. This is *Quality Assurance Provisions.* This section is, if any one section can be, the most important to the inspector. It provides the inspection criteria for in-process, end item, and packing inspection. In this section, the inspector will find the description of defects for the product. It also provides the information necessary for statistical inspection of the product.

Section 5 is *Preparation for Delivery.* This section provides requirements for the product's packing and packaging. Does the product need extra protection because it's going overseas and will be handled roughly? If so, this section will tell the inspector what these additional requirements for packing, packaging and marking (or PP&M) are.

Section 6. This is *Notes.* This section contains information of a general nature or information that may not fit into one of the other sections.

The product specification provides the inspector with a clear and detailed description of the product for in-process, end item, and packing, packaging, and marking inspections. Without these specifications, either military or Federal, the inspector could not inspect the product for quality.

DPSC Clauses, Articles, Conditions, Special Provisions, Instructions, and Forms. These are issued by the Directorate of Subsistence, Headquarters DPSC, and become part of the contract when referenced therein. DPSC general articles are generally concerned with actual product requirements, while DPSC Clauses are concerned with administrative requirements. DPSC conditions are concerned with instructions to bidders and usually relate to matters prior to the award of contracts.

Subsistence Inspection Manuals (SIMs). Inspection of subsistence for the Department of Defense is an important endeavor involving the health and satisfaction of millions of military personnel and the expenditure of millions of dollars for products which must possess specific quality characteristics. Many people, both civilian and military, participate in the inspection part of procurement. Inspection procedures must be uniform and realistic before inspection can be meaningful, fair, and legally binding on both the vendors and the Government. To provide uniformity, two manuals apply to the inspection of DPSC centrally procured subsistence. We military inspectors use DPSC Manual 4155.6 as a guide. Vendors who are required to inspect their own products prior to submission to the Government are governed by the DPSC Manual 4155.5, *Subsistence Contractor Inspection Procedures Manual* (SCIPM).

DPSC Subsistence Inspection Manual, (DPSC Manual 4155.6) DPSC not only buys the majority of subsistence items for the Armed Forces; they use Air Force environmental health and Army veterinary personnel to perform these inspections both at origin and destination. The quality assurance specialists assigned to the quality assurance office at SPEs use the "Location List" to locate personnel available for inspections.

Since the SPEs may be quite a distance from the plant or base, and many questions arise, Headquarters DPSC in Philadelphia PA has published the inspection guide called the *DPSC Subsistence Inspection Manual, 4155.6.* This inspection manual is designed to provide guidance for all personnel involved in the inspection of DPSC-procured subsistence, and it must be kept up to date at all times.

DPSC Subsistence Contractor Inspection Procedures Manual (DPSC Manual 4155.5). Just as the SIM provides guidance for you, the military inspector, the SCIPM *provides guidance for the contractor* in completing that vendor's inspection. The SCIPM tells the contractor how and when to inspect product and what records and reports must be submitted to the Government. The SCIPM also fully explains the Government verification inspection procedures and when the contractor must pay the Government inspection cost. The SCIPM is referenced in the Master Solicitation and, therefore, the contractor must follow the provisions therein. Failure of the contractor to follow these provisions is a contract noncompliance and should be reported to the SPE/CQAE. As you can see, you must not only be familiar with the SIM but also with the SCIPM, because if you do not know what is required of the contractor, you cannot evaluate his performance.

Exercises (644):

1. Match the document identification in column B with the inspection documents in column A by placing each letter in column B in the correct space provided in column A. Each item in colum B may be used only once.

Column A

___ (1) Contract.
___ (2) Specification.
___ (3) Clause.
___ (4) DPSC Form 300-1.
___ (5) Product annex.
___ (6) Request for proposal.
___ (7) DPSC conditions.
___ (8) DPSC SIM.
___ (9) DPSC Manual 4155.5.
___ (10) Master Solicitation.

Column B

a. Continuation of contract.
b. Takes precedence over any other referenced material.
c. Concerns administrative requirements for subsistence.
d. Contains instructions to bidders.
e. Booklet of solicitation terms, conditions, and instructions.
f. Clear, accurate, and detailed description of product requirements.
g. Contains item descriptions and technical material concerning the commodity.
h. Written notice to the industry that an item is to be purchased.
i. *Subsistence Contractor Inspection Procedures Manual.*
j. A guide to the inspection procedures for all DPSC subsistence.

Food Inspection

This chapter covers specific procedures involved in the inspection of subsistence. We will include the steps involved in accomplishing warranty actions, net weight determinations, identification of inspected subsistence, inspections for identity and conditions, identification of approved sources, nonconformance reporting, and conveyance inspection.

4-1. The Military Food Inspection Office

The military food inspection office is, for all intents and purposes, the only military office where enlisted personnel are actually intended to serve as *the* Air Force—you are the "eyes" and "ears"—and take action on problems with the full authority of the Air Force at your disposal.

You are required to be aware of the contracts you use for inspection purposes. Awareness is more than knowing where each is located in your office filing cabinet. You also have to know what the contract requires of the vendor, your office, and the receiving office. You must be familiar with, and use constantly, the inspection documents that are a part of each contract. You must be familiar with the inspection procedures that are outlined by each purchasing agency. You have to know when to use a procedure, and when not to.

You must be capable of clearly documenting your observations, verbalizing those observations, and making intelligent and useful recommendations for solving any of the problems you may observe.

You must display a professional image and use tact and diplomacy in your dealings with vendors, truck drivers, facility managers, and commissary officers. At the same time, you must have that untaught ability to know when you are right and maintain your convictions, regardless of the pressure applied for you to change your recommendations.

Basically, you need to be yourself. In order to provide you with the necessary technical knowledge, we will now discuss some of the objective information regarding food inspection.

645. Designate pertinent rules regarding supply warranty and right of recovery for perishable subsistence.

Supply Warranty and Right of Recovery. At the time of procurement, a supply warranty stipulating a right of recovery clause is agreed to by the contractor. Provision 44, DPSC Form 3020, Additional General Provisions, is referenced and incorporated into DPSC Form 3619, DPSC Master Solicitation for Perishable Subsistence [hereafter referred to as "the Master Solicitation"]. The conditions of these provisions are effective until the items have been the property of the Government for 120 days, unless stipulated otherwise in other DPSC documents.

These provisions simply state that the contractor agrees to refund to the Government or replace all subsistence that has spoiled in any way. The spoilage must be discovered prior to the expiration of the time period. The Government has 150 days after receipt of the product to notify the contractor of warranty action.

Since the spoilage of these items must be discovered prior to the end of the expiration period, an extensive inspection must be conducted of items held under the right of recovery, to determine the fullest extent of the condition. The accountable property officer is responsible for requesting this inspection and results must be reported to him. The Government shall not be entitled to refund or replacement of these items, unless the contract price of the items found spoiled exceeds $25.00.

Exercises (645):

1. Products purchased in accordance with the Master Solicitation are covered by a supply warranty for how many days?

2. The Government has how many days after receipt of the product at destination to notify the contractor of warranty action?

3. The contract price of the items spoiled must exceed how many dollars to entitle a refund or replacement under a warranty clause?

646. Provide significant inspection procedures for the weighing of subsistence.

Net Weight Determination. One of the more common inspection procedures is our weighing of subsistence, insuring that a product weighs not less than what the vendor has marked it. This protects the financial interests of the Government in the purchase of products for issue to dining facilities and those of the consumer in the net weight of the items that are intended for resale in the commissary.

Terms defined. Prior to discussing net weighing procedures, several terms are defined.

Gross weight. This refers to the weight of product and packing, packaging, and labeling.

Tare weight. This is just the weight of packing, packaging, and labeling.

Net weight. This is the weight of the product.

Marked net weight. The vendor's product weight is the marked net weight.

Actual net weight. The actual net weight or inspector's product weight refers to what you actually find when you weigh a sample.

Average unit shortage. This is determined by dividing the total shortage by the number of units or $\frac{\text{total shortage}}{\text{no. of sample units}}$.

Average unit net weight. This is determined by dividing the total net weight of the samples by the number of units or $\frac{\text{total net weight of the samples}}{\text{no. of sample units}}$.

Categories of products. There are two categories of products in terms of weight weights: standard weight items and variable weight items.

Standard weight items. These are those which, regardless of the container, must weigh the same. Examples include most prepackaged items such as milk, resale luncheon meats, and resale packages of potato chips. With items such as these, *any* shortage is considered to be significant, and the item should be reported to the procuring agency as nonconforming.

Variable weight items. The second category includes those items the packing of which results in variable weights between packages. Wholesale meat cuts are a good example of this type of product. Each box or package may have a different weight from other boxes or packages of the product.

Methods of determining net weight shortage. There are two methods of determining whether a net weight shortage exists. One method requires comparison of the average net weights of the product.

First method. In this method the *actual* net weight must be *at least equal* to the *marked* net weight. If not, a shortage exists. The product should be reported as nonconforming. This method is the *only* acceptable method for net weighing standard weight items, while it *may* be used for net weighing variable weight items.

Second method. The second method in use for determining a significant net weight shortage involves the use of a procedure outlined in the DPSC-SIM. In this procedure, the vendor is given an allowance for differences between actual and marked net weights. As outlined in the DPSC-SIM, this procedure can be used *only* on variable weight products being procured by DPSC (unless it is referenced by the purchase instrument for non-DPSC items). For a more detailed description of this procedure, consult DPSCM 4155.6, Subsection 213.7.

Unless otherwise specified, AF Form 1553, Net Weight Examination Record, (fig. 4-1) should be used to record the results of net weight examinations. It may be used for either standard weight products or variable weight products. To determine the representative sample size for net weighing, inspection level S-4 from MIL-STD 105 is recommended.

Examination of "brand name" items for significant net weight shortage will normally be made at destination. Such examinations are not usually made in great detail but rather on a "spot check" basis to insure that marked net weights are accurate. Weight allowances for "brand name" products procured under Supply Bulletin 10-500 can be found in Section I, "General Instructions for Brand Name Contracts," of that Supply Bulletin. Each base environmental health office should maintain a file of tare weights provided by the vendor on whose items delivered directly to the base and receiving a class 4, 5, or 8 inspection.

Procedures for conducting and reporting net weight verification of supplies on DPSC contracts can be found in DPSCM 4155.6, Subsection 213.7.

Exercises (646):

1. On what document are net weight determinations recorded?

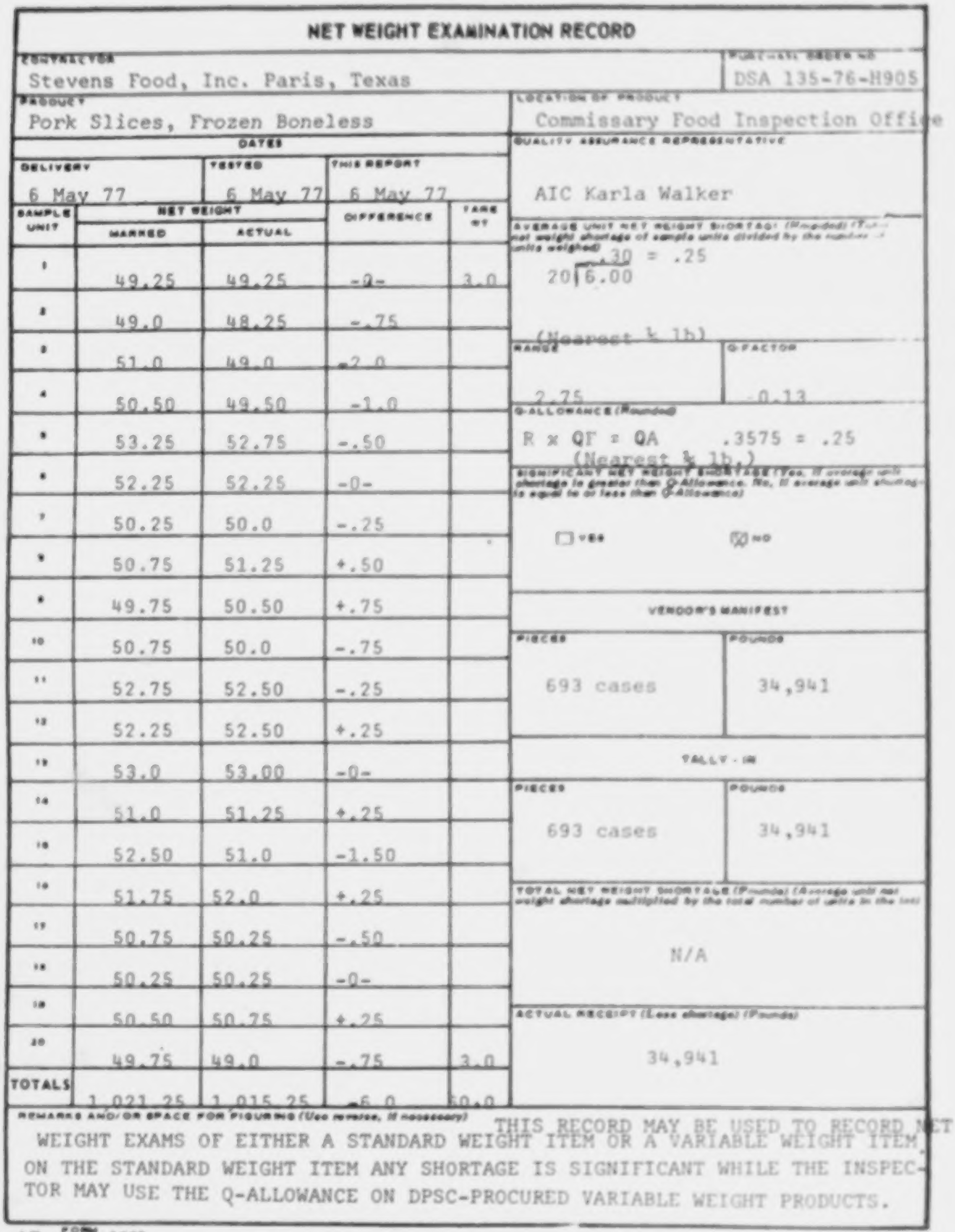
2. What term refers to the weight of the packaging, packing, and product?

3. Procedures for conducting and reporting net weight verification are found in what DPSC manual?

4. How is average net weight shortage determined?

647. Classify selected procedures for inspection for identity and condition of subsistence.

Inspection for Identity. Inspection for identity is a means of determining whether or not the product delivered is the one specified by the contract as to item, style, class, type, and grade. It also includes determining whether or not the product being received is the same item as that which was inspected at origin. This may be done by surveying the containers for inspection stamp impressions, lot numbers, purchase order numbers, and item nomenclature. This should be verified by checking inspection reports and certificates, invoices, and manifests. To further authenticate the identity of the product, containers should be opened for physical examination of the product itself. If there is reason to suspect substitution or fraud, additional units should be inspected to determine the extent of the assumed problem. Remember, if fraud is likely, you should contact your base Office of Special Investigations (OSI). If the product is being received and inspected under class 4 inspection, you should also notify the State and Federal inspection agencies responsible for that product. Maintain all your paperwork and notify your NCOIC and OIC of the potential problem.



NET WEIGHT EXAMINATION RECORD

CONTRACTOR: Stevens Food, Inc. Paris, Texas

PURCHASE ORDER NO.: DSA 135-76-H905

PRODUCT: Pork Slices, Frozen Boneless

LOCATION OF PRODUCT: Commissary Food Inspection Office

DATES

DELIVERY: 6 May 77

TESTED: 6 May 77

THIS REPORT: 6 May 77

QUALITY ASSURANCE REPRESENTATIVE: AIC Karla Walker

SAMPLE UNIT	NET WEIGHT		DIFFERENCE	TARE WT
	MARKED	ACTUAL		
1	49.25	49.25	-0-	3.0
2	49.0	48.25	-.75	
3	51.0	49.0	-2.0	
4	50.50	49.50	-1.0	
5	53.25	52.75	-.50	
6	52.25	52.25	-0-	
7	50.25	50.0	-.25	
8	50.75	51.25	+.50	
9	49.75	50.50	+.75	
10	50.75	50.0	-.75	
11	52.75	52.50	-.25	
12	52.25	52.50	+.25	
13	53.0	53.00	-0-	
14	51.0	51.25	+.25	
15	52.50	51.0	-1.50	
16	51.75	52.0	+.25	
17	50.75	50.25	-.50	
18	50.25	50.25	-0-	
19	50.50	50.75	+.25	
20	49.75	49.0	-.75	3.0
TOTALS	1,021.25	1,015.25	-6.0	60.0

AVERAGE UNIT NET WEIGHT SHORTAGE (Pounds) (Total net weight shortage of sample units divided by the number of units weighed)

$20\overline{)6.00}$ .30 = .25

(Nearest ¼ lb)

RANGE: 2.75

Q-FACTOR: 0.13

Q-ALLOWANCE (Pounds)

R x QF = QA .3575 = .25

(Nearest ¼ lb.)

SIGNIFICANT NET WEIGHT SHORTAGE (Yes, if average unit shortage is greater than Q-Allowance. No, if average unit shortage is equal to or less than Q-Allowance)

☐ YES ☒ NO

VENDOR'S MANIFEST

PIECES: 693 cases

POUNDS: 34,941

TALLY-IN

PIECES: 693 cases

POUNDS: 34,941

TOTAL NET WEIGHT SHORTAGE (Pounds) (Average unit net weight shortage multiplied by the total number of units in the lot): N/A

ACTUAL RECEIPT (Less shortage) (Pounds): 34,941

REMARKS AND/OR SPACE FOR FIGURING (Use reverse, if necessary) THIS RECORD MAY BE USED TO RECORD NET WEIGHT EXAMS OF EITHER A STANDARD WEIGHT ITEM OR A VARIABLE WEIGHT ITEM. ON THE STANDARD WEIGHT ITEM ANY SHORTAGE IS SIGNIFICANT WHILE THE INSPECTOR MAY USE THE Q-ALLOWANCE ON DPSC-PROCURED VARIABLE WEIGHT PRODUCTS.

AF FORM JUL 76 1553

Figure 4-1 Sample of AF Form 1553.

Inspection for Condition. Inspection for condition includes examination of packaging and packing materials and the product itself and is performed to determine whether or not the product is fit for storage and/or immediate or ultimate consumption. Packaging and packing material must not be damaged in such a manner that it will not afford adequate protection of the product.

The product must be in excellent condition and suitable for storage and/or consumption. It must be free of deterioration, spoilage, contamination, and foreign or objectionable odors. Internal temperatures, when applicable, must be in accordance with contractual requirements. The internal temperature of a product may also be an element of the identity inspection. For example, if the contract specifies a frozen product, the item must have an internal temperature that makes it actually frozen and not merely hard chilled. If a questionable condition is found, additional samples must be selected to determine the extent of the condition.

Exercises (647):

Determine if each situation in items 1 through 4 involves "inspection for identity" or "inspection for count" and write either the term "identity" or the term "condition" beside that exercise number.

1. Inspection for style, class, and grade.
2. Inspection of item to determine if it is the same item that was shipped from origin.
3. Inspection performed to determine if the product is suitable for storage.
4. Inspection to determine deterioration.

648. Label various agencies that provide lists of approved sources for specified military supply items.

Approved Sources of Supply. To insure the wholesomeness of the procured product, the establishment where products are processed must be inspected. Processing must be conducted in a sanitary environment to include acceptable facilities, potable water, sanitary methods of handling the product, proper protection of the product during processing and storage, and proper transportation methods and equipment. The policies and procedures for determining whether or not the product is from an approved source of supply are covered in AFR 163-2, *Veterinary Food Inspection*, Chapter 2, *Inspection of Food Establishments*.

All food products do not pose a potential health threat as a result of their processing, and it is not practical to have a sanitary surveillance program for all food facilities. With this in mind, AFR 163-2 lists foods by groups and designates whether or not a product group is exempt from required listing as a sanitarily approved source. It also allows certain exceptions from these requirements, if specific circumstances exist.

A system of determining whether or not a product was produced in a plant recognized as an approved source is available to the inspector. This is done by using lists published either by military or nonmilitary agencies. These lists are briefly discussed in the following paragraphs; more detailed information may be found in AFR 163-2.

The Environmental Health Services do not intend to duplicate the sanitary inspections of other Federal agencies or of acceptable State agencies. Animal origin products receive antemortem and postmortem inspections from several such agencies, and these inspections include surveillance of the sanitary condition of the processing establishment. These agencies publish lists of those plants in which these inspections occur, and these plants are to be considered as approved sources of supply. Since they are not inspected by the Environmental Health Services, they do not appear on a sanitary source list published by a military agency.

OSDA lists. The U.S. Department of Agriculture (USDA) publishes several lists (designated in AFR 163-2) which contain the names of plants in which their agency provides inspection services and insures the sanitary status of the facilities. These plants process red meats, poultry, and eggs and are considered as sanitarily approved sources of supply by military food inspectors. Some state inspection programs are considered by the USDA to have standards at least equal to the Federal standards, and their programs are also acceptable to the military services. The document pertaining to these USDA-approved state inspection programs is also referenced in AFR 163-2. Among the lists published by the USDA are: "Directory of Meat and Poultry Inspection Program Establishments and Officials" and "List of Plants Operating Under USDA Poultry and Egg Inspection and Grading Programs."

USPHS lists. The US Public Health Service (USPHS) of the Department of Health, Education, and Welfare publishes a list titled "Sanitation Compliance and Enforcement Rating of Interstate Milk Shippers." Plants listed in this document receive inspections by state milk sanitation officers and must receive scores of not less than 90 to maintain their listed status. Plants appearing on the "Interstate Milk Shippers" list are considered to be approved as sources of fresh dairy products without further plant inspections by the military veterinary services.

The USPHS also publishes the "Interstate Certified Shellfish Shippers List," which lists plants that process oysters, clams, and mussels. The USPHS only certifies that the waters from which these products originated were sanitary. The processing of the product requires a separate certification. Plants listed in the "Guides" do not require military veterinary inspections for sanitary processing.

The "Directory of Sanitarily Approved Food Sources for Armed Forces Procurement (In CONUS)." This is an approved sources list. It is the largest and most involved list published by the military. The "Directory," as it is commonly called, is published by the US Army's Health Services Command annually, with revisions semiannually. Those companies listed in the "Directory" are inspected by representatives of the

Army, Veterinary Service, who recommend to the HSC commander that the plants be approved as sources for U.S. Armed Forces procurement. Any company wishing to serve more than one military installation must appear in the "Directory."

Local lists. Those companies wishing to serve only one installation may appear on a "Local" list maintained by the base Environmental Health office. These companies are also inspected by representatives of the Environmental Health services. The inspection results, along with appropriate recommendations, are forwarded to the installation commander for final approval or disapproval.

A company wishing to serve an installation must submit a written request for inspection. This request must go through a procurement office, which indicates whether or not the government desires to purchase the product. This precludes the inspection of plants that process products that are not needed by the military services. If the company wishes to sell to more than one installation, this request is sent to HSC which then assigns the actual inspection to a specific US army veterinary office. This assignment is determined by reviewing the "Location of Military Personnel Available for Inspection and Services" (commonly referred to as the "Location List") published by the Surgeon General, Department of the Army.

A company wishing to serve only one base forwards the request to the purchasing agent who desires to buy the product. It is then forwarded to the base Environmental Health officer.

Exercises (648):

Determine each agency that provides the approved sources for each subsistence item listed in exercises 1 to 4:

1. Hams, bacon, and fresh pork products.

2. Eggs and poultry.

3. Ice cream and whole milk.

4. Bakery products listed in the Directory.

4-2. Receipt Inspections

The receipt, or procurement, classes of inspection include classes 4 and 8. These inspections are conducted on products that are being offered to the Government for purchase. These two procurement classes of inspection are discussed here in the order in which they will normally appear to you. In these two classes of inspection, recommendations for rejection may be made. The various avenues of action you may take when such an action is necessary, as well as the various corrective measures available within these classes, are discussed with each class.

649. Cite specific requirements of the receipt classes of inspection.

Class 4 Inspection (On Delivery at Purchase). This inspection is made when food is delivered to the Armed Forces for purchase. Foods inspected under class 4 inspection are not yet owned by the Government. This inspection tests compliance with contractual requirements for sanitation, wholesomeness, and quality. It is the last inspection of the food items offered for sale before the ownership of the food is transferred to the Government—i.e., until the food is legally bought by the Air Force.

Class 4 inspections are normally limited to condition, identity, and net weight test procedures. As used here, *condition* refers to the state of the product and its packaging at the time of delivery. *Identity* refers to the specific contract item—i.e., what was asked for in the contract must be what is delivered. Net weight test procedures involve determining whether or not the contracted amounts, or weights, of the specific product have been delivered as ordered.

This limited class 4 inspection will be the normal inspection when the shipment is accompanied by a Certificate of Conformance. This form is used to certify that the transported product has met all terms of the referenced contract at the time of shipment. If such a certificate accompanies the shipment, a limited destination inspection must be performed. In addition, when the contract you are using to inspect the product specifically calls for this limited destination inspection, you must perform one, and you do not add anything to the inspection.

When no Certificate of Conformance accompanies a shipment to your base, you are required to perform a class 4 inspection that assures compliance with all of the contract's requirements; e.g., delivery time, grades, packaging—everything that the contract specifies.

As a food inspector, you are responsible for providing the inspection on a timely basis. Your recommendations will be used to determine whether a shipment of food will be accepted or rejected by the receiving officer. Remember, the perishability of the foods being inspected may have a bearing on what your final recommendations will be. It is, therefore, your responsibility to review all of the relevant purchase documents; i.e., the contract, the master solicitation, the technical data sheets, the product specifications, and any additional documents used as part of the contract, and to become familiar with the delivery requirements stated in each. If you are not current with your purchase instruments, you cannot provide the thorough inspection needed to insure the continued good health of the command. You are also failing to protect the financial interests of the Government you have sworn to serve.

Class 8 Inspection (Purchase by Nonappropriated Fund Activities). This inspection is made on all foods being delivered to nonappropriated fund activities. The officers open mess, the NCO open mess, the AAFES food facilities—these are examples of the types of nonappropriated fund (NAF) activities that use your inspection service. As with the class 4 inspection, foods delivered to NAF activities are not owned by the Government until you have inspected them for contract compliance and wholesomeness. Again, your inspection will be used to determine whether the foods will be accepted or rejected by the NAF facility's receiving officer.

Normally, when you are conducting a class 8 inspection, you are required to inspect all animal-origin and perishable foods. Semiperishables need not be inspected during class 8 inspection, unless the receiving facility makes an inspection request of you. In most cases, you will be inspecting these class 8 deliveries at the food inspection office. When necessary, however, you should be available to inspect these deliveries at the receiving facility.

When a NAF activity is supporting a nonmilitary concession at your base (state-operated facilities for the blind, for example), and military personnel and their dependents may use that facility, you must inspect foods that are to be delivered to them.

Reporting Nonconformances. You will be required to document delivery nonconformances. These are "facts of life" in this job. They are not, however, an opportunity for you to become vindictive towards a particular vendor or facility manager. Your professional bearing and attitude must be at its highest when you are documenting nonconformances related to your food inspection duties.

From our previous discussion about contracts, you know that these instruments are the guiding authority for your inspection. You cannot, at any time, add requirements for a food item or its delivery unless the vendor, the contractor, and the receiving facility have all agreed—in writing as an amendment to the contract—to do so. DPSC uses both requirements-type and standard-type contract in purchasing foods for Armed Forces use. A *requirement-type* contract is a contract that specifies an estimated quantity of product to be delivered over a specific period of time. An example would be a shell egg contract that required an estimated delivery of 50,000 dozen eggs over a 6-month period. At the end of that 6-month period, the contract would end and no further purchase on that contract could, or would, be made. A *standard-type* contract is a contract that required a specific amount of product to be delivered on a specific date. An example would be a contract that required 700 pounds of butter to be delivered on the 6th of June, before 1200.

AAFES uses a contract, called a *purchase order,* that is similar to a DPSC requirement-type contract. The differences are that the AAFES contract will set longer periods of delivery—perhaps one or two years—and may call for certain products to be delivered to different locations on your base in different conditions. An example would be an AAFES purchase order that calls for a manufacturer to deliver one of their sausage products to three AAFES facilities on your base. At the first two, the sausage would have to be frozen, while at the third, it need only be chilled at delivery.

Your determination of nonconformance must, as we have said earlier, be based solely upon the information provided you in these contract documents. You cannot apply the requirements from one contract to another contracted delivery; i.e., you cannot make an AAFES vendor meet a DPSC contract requirement, and you must always apply the requirements of a specific contract to that contract's delivered product. When you document nonconformances, you must be sure to state exactly what contract is being used to determine the nonconformance. You must be specific in detailing the exact nature of the nonconformance. If the delivery is late, how late is it? If the delivery is short-weight, how short is it? If the delivery is rejected, who rejected it and why? How much was rejected? You are directly involved in these incidents, but the reader of your report is not. You must therefore record an accurate and detailed picture for that reader, so that a determination may be made fairly about the disposition of the product in question.

Do not rely on rejections alone to solve your product problems. Price adjustments, contract and specification modifications, waivers from the contractor—all of these can be used to bring a product to the consumer and to save the Government needless expenditure of funds.

Keep in mind that your duties as a food inspector will bring you into contact with other Air Force agencies and other branches of the Armed Forces. Each of these organizations has its own rules and regulations regarding procedure and policy. It is an effort in futility for you, an Air Force food inspector, to attempt to change an Army food inspection procedure, simply because you disagree with it. At the same time, it is both unprofessional and immature for you to act in any manner that would bring discredit or embarrassment to your office or your coworkers. Cooperation and understanding will go much further in solving interagency problems.

Exercises (649):

1. Which class of food inspection is used to inspect nonappropriate fund activity food deliveries?

2. What class of food inspection is used to inspect all other foods not yet owned by the Government?

3. In a limited destination class 4 inspection, for what would you inspect the product?

4. Who is responsible for reviewing contracts for delivery requirements?

5. What must be inspected under a class 8 inspection?

6. What is the difference between a DPSC requirements-type contract and a DPSC standard-type contract?

4-3. Surveillance Inspections

The surveillance classes of inspection include classes 5, 6, 7, and 9. These inspections are conducted on products that are already owned by the Government. The individual classes are discussed in the order in which they normally occur to you, the food inspector. In most cases you cannot recommend rejection of these items because they are already Government-owned. This does not mean that you have no recourse if the product is unsatisfactory. The various avenues of action you may take are discussed with each class of inspection.

650. Supply selected requirements of the surveillance classes of inspection.

Class 5 Inspection (Any Receipt Except Purchase). Inspections of Government-owned foods are performed at the time of receipt from other Government agencies or facilities of a commercial contractor when the product has previously been accepted by the Government at that place. This inspection must include the sanitary conditions of the conveyances in which the supplies were *transported for delivery*, and the *condition* and *age* of the product at the time of receipt. Many items of subsistence no longer have expiration dates. They are stamped with "inspection test dates," which signify the expected shelf life under normal conditions. When an item of subsistence reaches its inspection test date, the product should not be simply condemned or force-issued. As the term "inspection test date" implies, the item must be thoroughly reinspected to determine whether it is still suitable for its intended use. Depending on the condition of the product and its perishability, the base Environmental Health OIC must establish a new inspection test date and so advise the commissary officer.

Subsistence may be received that has exceeded its inspection test date/expiration date or has received an "on paper" extension of the inspection test date. Receipt of this type of subsistence requires special action. Environmental Health Service personnel must immediately examine the product. If no quality defects are found, notify the AF center and the subsistence depot, using DD Forms 1232, Quality Assurance Representative's Correspondence (AFESC), or DD 1234, Report of Inspection of Subsistence Products. If the product quality or serviceability is affected, a DD Form 1608, Unsatisfactory Material Report (Subsistence), should be submitted to AFESC.

When damage in transit is noted during a class 5 inspection and a commercial carrier is found liable for the loss, you should notify the receiving officer and the base transportation officer. If the product is acceptable, complete a DPSC Form 4572, Report of Carrier Equipment, Load and Item Discrepancies, with adequate explanatory remarks and mail the original through the Contract Quality Assurance Element (CQAE) to the Defense Supply Office (DSO) or Subsistence Procuring Element (SPE) for action. If the product is *not* acceptable, report this immediately to the CQAE at the DSO/SPE prior to *rejection to the carrier*. Complete the DPSC Form 4572 and other required documentation and forward this to the CQAE.

When government carriers are found liable for loss during transit and the loss is more than $10.00, report this to the receiving officer and the base transportation officer. Notify the CQAE of this action and forward any requested documentation. Document your inspection on a DD Form 1234.

In summary, our responsibilities in the area of class 5 inspections are as important as those involved in a class 4 inspection. We are the "QAR" for the "troops." If we do not examine and document each shipment of class 5 subsistence received at "our" base, then it will be impossible to assure that the product has not exceeded its intended shelf life and, furthermore, has not deteriorated to the point that it is *inedible*.

Class 6 Inspection (Prior to Shipment). These inspections are performed on food items immediately prior to shipment. They are conducted at DPSC supply points and depots before shipment to military installations, and they are also conducted at military installations that are shipping food items in support of sites or outposts.

These inspections are conducted to advise the accountable property officer (either the DPSC supply point or depot officer or base commissary officer) as to compliance or noncompliance of the carrier with requirements for proper temperature, loading, etc., and as to the suitability of the product for its intended use.

Many class 6 shipments, especially those from DPSC, are made on vehicles which are owned and operated by civilian trucking agencies. They are hauled on AF Form 1335, Government Bill of Lading (GBL), issued by the transportation officer at the accountable DPSC.

There are several types of documents with which the foods are transferred from one account to another, both for perishable and nonperishable items. They are commonly referred to as "shipping documents" or "shipping tickets." These are usually mailed to the receiving installation, but some are sent with the shipment. An example is DPSC Form 2005-1, Standard Use Multi-Requisitioning/Shipping, on which DPSC lists perishable items being sent to military installations.

DPSC requires that vehicles be precooled to 45°-50° F (7-10° C) for chilled products and to 0° F (−18° C) for frozen shipments prior to loading. This insures that the refrigeration equipment is operating properly and removes the body heat from the vehicle. The trailer body must be completely tight when the doors are closed, and the interior must be free of foreign odors which could transfer to the products after loading. Side walls and racks must be clean, and blankets or other equipment used as barriers must be clean and odorless. No other freight, other than food for human consumption, may be included in the shipment. Loads may not be stacked higher than 10 inches from the ceiling to allow for proper air circulation.

Inspection of the product includes consideration of required temperatures, proper stock rotation from the warehouse, suitability for further storage at the destination, etc. Such inspections are conducted in accordance with the directives issued by the accountable agency.

Class 7 Inspection (At Issue or Sale). These inspections are made to insure that no contaminated, decomposed, or otherwise unwholesome food is issued or offered for sale. It is performed at the time subsistence is issued from the warehouse to troop dining halls, or to the commissary resale store after receipt and prior to issue. Class 7 may require up to 100 percent inspection of all foods at the time of issue or sale.

The vehicles used to transport these items from the storage areas to the users should be the best available to protect the items involved.

Class 9 Inspection (In-Storage). Class 9 inspections are conducted to detect early signs of deterioration and to advise the accountable property officer, so that arrangements can be made to issue or otherwise dispose of such foods before losses are sustained. They are also conducted to detect faulty temperatures, warehouse facilities, or storage, handling, and product rotation practices which may lead to deterioration.

Procedures for in-storage inspections of DPSC controlled stocks are outlined in DPSCM 4155.7, *In-storage Quality Control and Inspections.* Procedures for inspection of Air Force stocks in the account commissary officers is governed by Chapter 5 of AFCOMSR 145-2, *Store Operations* and by AFR 163-2, *Veterinary Food Inspection.*

Class 9 inspections should be conducted at installations of the Army and Air Force on a monthly basis for perishable foods that have been on hand in storage for over 30 days. This class of inspection should also be performed for nonperishable foods, other than subsistence reserves, individual inflight and survival food packets, on hand in storage for over 90 days.

Your class 5 records are invaluable in the accomplishment of class 9 inspections. They will provide information on the date of receipt, condition, and age and recommendations for usage of all items received. Remember: our objective is not to locate those products that have deteriorated in storage but to prevent in-storage deterioration by proper surveillance. Furthermore, *your primary goal* is to identify poor quality products during your class 5 inspections and to make proper recommendations for their disposition, so that your class 9 inspections result in fewer monetary losses in subsistence items.

Exercises (650):

1. A class 9 in-storage inspection on perishable products is performed on those products which have been in storage how many days?

2. What does a class 5 inspection include inspection of?

3. When a class 5 shipment is received and the product quality or serviceability is affected, what should be submitted and to what organization?

4. For class 6 shipments, DPSC requires that vehicles be precooled to what temperature (Fahrenheit) for chilled products and to what temperature (Fahrenheit) for frozen shipments?

5. What inspections are performed at the time subsistence is issued?

6. Preventing in-storage deterioration by proper surveillance is our primary goal when conducting what kind of inspection?

7. Procedures for in-storage inspections of DPSC stocks are found where?

651. Join various situations/purposes with their applicable forms.

Reports and Records. It is impossible for any individual to remember all business transactions conducted within a year or month; therefore, complete and accurate records must be kept. This unit discussed those records pertinent to subsistence inspection.

AF Form 1148, Daily Food Nonconformance Record—Classes 4 and 8. This form is used to record the value of food inspected for classes 4 and 8. Monetary values of products "passed" need not be entered daily, if the data are obtained from the receiving office (commissary, fiscal control office exchange). However, data and remarks on rejections must be entered daily for each line item and each class 4 and 8 inspection. Values may be "rounded off" to the nearest dollar in accordance with DPSC Manual 4155.12A Computation Guide.

DD Form 1234, Report of Inspection of Subsistence Products. The DD Form 1234 is prepared for each origin (class 3 inspection) lot whenever AQLs and Tables of Defect Classification are not contained in the Quality Assurance Provisions of the end item specification, for shipments of preaward inspection lots, for transshipments for freezing, and for destination rejections or other inspections where another DD form is not applicable.

The destination QAR (perishable and nonperishables) must prepare DD Form 1234 only as required for local use. Inspection personnel not signing the inspection block of the receiving report should insure that the authorized government representative completing this report is furnished with a complete copy of DD Form 1234, or the appropriate information therefore, including discrepancies that require contractual actions. In destination inspections without discrepancies, furnishing DD Form 1234 should be mutually agreed upon with the receiving officer. Block by block instructions on the completion of the DD Form 1234 is outlined in DPSCM 4155.6, Subsection 213.6.

DD Form 1232, Quality Assurance Representative's Corespondence. The DD Form 1232 is used to make a narrative report of the inspection of subsistence and will normally be forwarded to another quality assurance representative. The completion of this form is relatively self-explanatory.

DD Form 1608, Unsatisfactory Material Report (Subsistence). The DD Form 1608 is the form to use when reporting unsatisfactory subsistence that is owned by the Government, the cause for the unsatisfactory nature of the subsistence of which was beyond the control of your base. Step by step instructions on the completion of the DD Form 1608 can be located on the back of the DD Form 1608 and in the Consumer Level Quality Audit Program Handbook (COLEQUAP). An officer should sign the report. If two agencies collaborate in the submission of a UMR; e.g., Food Service and Environmental Health Services, both officers should sign the 1608. The completed DD Form 1608 is submitted through the command Environmental Health officer to Air Force Engineering and Services Center.

AAFES Form 6500-20, Subsistence Inspection Report. The AAFES Form 6500-20 should be utilized to report nonconformances of Exchange Service products. You should immediately call the activity manager and advise that a nonconforming shipment is being delivered. The facility manager will determine whether the product will be rejected or accepted. You should complete the AAFES Form 6500-20 in four copies, listing the products involved, the reasons for nonconformance, the quantities involved, contractor information (address, etc.), and the facility manager's decision on disposition of the identified products. The original of the AAFES Form 6500-20 is sent to the contracting officer; copy 1 is sent to the exchange facility involved in the disposition decision, copy 2 is sent to the AAFES regional office responsible for your AAFES region, and copy 3 is used as your file copy.

DD Form 250, Material Inspection and Receiving Report (MIRR). This is the form normally used as an invoice for nonperishable subsistence. It should be prepared by the contractor and be signed by the origin and destination inspectors when the supplies are acceptable. Destination inspectors will find the MIRR used as a receiving report for shipments under a DD Form 1155, Order for Supplies or Services/Request for Quotations, and when DPSC Form 300s, Order for Subsistence, have been lost or are otherwise missing. In the latter cases the commissary officers will prepare the form. The use and preparation of the form is covered in DPSC Manual 4155.6, subsection 213.5.

DPSC Form 300-2, Receiving Report of Order for Subsistence. The DPSC Form 300-2 is located on the back side of the DPSC Form 300 and is used to annotate items received, nonconformances, and rejections associated with this specific DPSC Form 300. The DPSC Form 300-2 must be signed by the inspector and the receiving agent.

DD Form 1155, Order for Supplies or Services/Request for Quotations. The Form 1155 is used to identify requirements on products purchased as local purchase items.

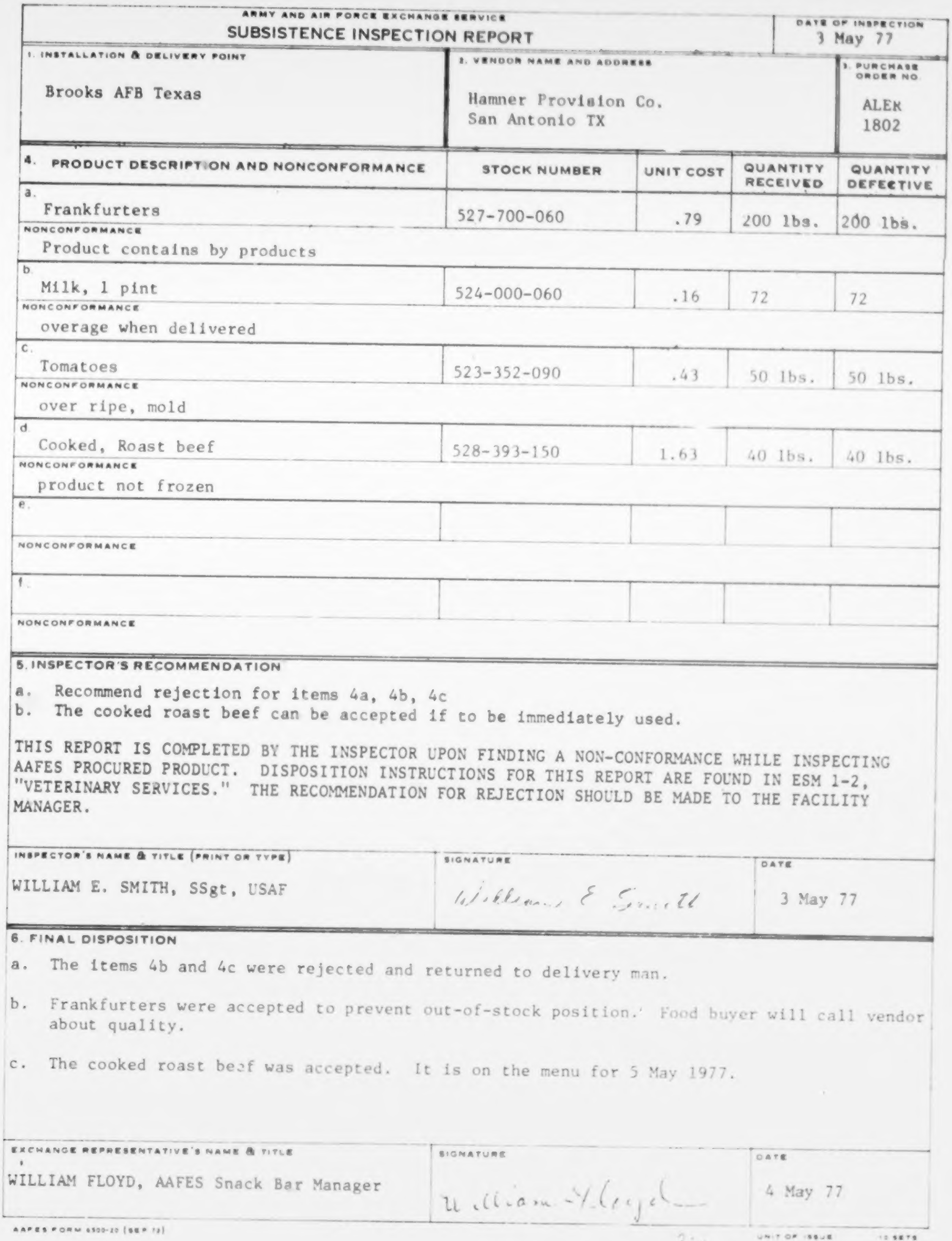
Exercises (651):

1. Match each situation/purpose in column B with its related form numbers in column A by placing the correct letter in the blank provided. Column B selections may be used once, more than once, or not at all.

Column A	*Column B*
___ (1) DD Form 1234.	a. Reporting subsistence inspections at origin when no AQLs are given.
___ (2) DD Form 1232.	b. Used to report damage of Government supplies on Government carriers.
___ (3) DD Form 1608.	c. Used for corresponding with other inspectors.
___ (4) DD Form 250.	d. Used to document rejections of class 4 resale items.
___ (5) AF Form 1148.	e. Daily food inspection record class 3.
	f. Reporting of inedible foods during class 5 inspection.
	g. Daily food inspection record classes 4 and 8.
	h. Material Inspection Receiving Report.

4-4. Consumer Level Quality Audit Program (COLEQUAP)

THE CONSUMER level quality audit program (COLEQUAP) and its purpose have seemed to confuse and irritate food inspection personnel since this program's inception over a decade ago. The confusion and irri-



ARMY AND AIR FORCE EXCHANGE SERVICE

SUBSISTENCE INSPECTION REPORT

DATE OF INSPECTION: 3 May 77

1. INSTALLATION & DELIVERY POINT: Brooks AFB Texas

2. VENDOR NAME AND ADDRESS:
Hamner Provision Co.
San Antonio TX

3. PURCHASE ORDER NO.: ALEK 1802

4. PRODUCT DESCRIPTION AND NONCONFORMANCE	STOCK NUMBER	UNIT COST	QUANTITY RECEIVED	QUANTITY DEFECTIVE
a. Frankfurters	527-700-060	.79	200 lbs.	200 lbs.
NONCONFORMANCE: Product contains by products				
b. Milk, 1 pint	524-000-060	.16	72	72
NONCONFORMANCE: overage when delivered				
c. Tomatoes	523-352-090	.43	50 lbs.	50 lbs.
NONCONFORMANCE: over ripe, mold				
d. Cooked, Roast beef	528-393-150	1.63	40 lbs.	40 lbs.
NONCONFORMANCE: product not frozen				
e.				
NONCONFORMANCE				
f.				
NONCONFORMANCE				

5. INSPECTOR'S RECOMMENDATION

a. Recommend rejection for items 4a, 4b, 4c
b. The cooked roast beef can be accepted if to be immediately used.

THIS REPORT IS COMPLETED BY THE INSPECTOR UPON FINDING A NON-CONFORMANCE WHILE INSPECTING AAFES PROCURED PRODUCT. DISPOSITION INSTRUCTIONS FOR THIS REPORT ARE FOUND IN ESM 1-2, "VETERINARY SERVICES." THE RECOMMENDATION FOR REJECTION SHOULD BE MADE TO THE FACILITY MANAGER.

INSPECTOR'S NAME & TITLE (PRINT OR TYPE)	SIGNATURE	DATE
WILLIAM E. SMITH, SSgt, USAF	William E. Smith	3 May 77

6. FINAL DISPOSITION

a. The items 4b and 4c were rejected and returned to delivery man.

b. Frankfurters were accepted to prevent out-of-stock position. Food buyer will call vendor about quality.

c. The cooked roast beef was accepted. It is on the menu for 5 May 1977.

EXCHANGE REPRESENTATIVE'S NAME & TITLE	SIGNATURE	DATE
WILLIAM FLOYD, AAFES Snack Bar Manager	William Floyd	4 May 77

AAFES FORM 6500-20 (SEP 73) UNIT OF ISSUE 10 SETS

Figure 4-2 Sample of AAFES Form 6500-20.

tation are caused by the fear of the unknown. In this chapter we will explain the program and its value to the Environmental Health Service. The procedures are similar to the procedures used in verification inspection with one major difference. The difficulty index is much lower, and the program can be managed and run by any Environmental Medicine specialist with the desire to do a good job. The procedures for accomplishing the COLEQUAP require that you be organized in order to complete it correctly and on time. Coordination between different agencies on base is part of the program and is essential for successful completion. The consumer level quality audit program (COLEQUAP) is a base-level program jointly conducted by the food service and the Environmental Health service, with commissary cooperation. It is a program by which we can determine certain things about specific issue subsistence items that have been centrally procured by the Defense Personnel Support Center (DPSC). We wish to find if these items are acceptable to food service patrons and if they fulfill food service requirements for specific quality characteristics. In additions to these analyses by food service personnel, Environmental Health personnel provide statistical data relative to the quality characteristics of each audited item. This is normally done by auditing the item according to the specifications that were used to procure it.

652. Indicate the validity of various purposes of and benefits derived from COLEQUAP.

Purposes. COLEQUAP is a program that generates valid and detailed feedback information from the users of issue subsistence. This information is then used by the planning, procuring, and inspecting agencies, so that they can improve the quality of subsistence procured for and delivered to Department of Defense installations. Several purposes are cited in AFR 74-10, *Consumer Level Quality Audit Program* (COLEQUAP). These are paraphrased:

a. Inspect Government-owned issue subsistence for *condition* and the *quality* characteristics they are supposed to possess.

b. Determine if these foods are fulfilling food service and commissary mission requirements to provide patrons with nutritious and appetizing foods that can be stored, prepared, and served with the maximum of efficiency.

c. Report all findings in the form of valid and detailed information to those agencies that can correct any deficiencies that may be brought out by analysis of the information.

d. Report the receipt of substandard subsistence at our bases, so that special action can be directed against the cause of the condition.

e. Serve as the foundation for technical action to improve subsistence and protect the financial interest of the Government.

In addition to providing data to fulfill these overt purposes of COLEQUAP, the Environmental Health Service is benefited in two other ways. The base Environmental Health office is in a position to actually be responsible for changes in food specifications and in quality requirements of subsistence in the military supply system. Food service and commissary personnel should have a deeper respect for support at the base level when the Environmental Health Service shows an interest in such problems as food quality and portion control. COLEQUAP also serves as a vehicle for training inspection personnel in the complex system of military food procurement and quality assurance. This training is basic to the individual qualifications needed for procurement inspection. Thus, if a base Environmental Health officer and you, as a member of the staff, are later thrust into procurement inspections, you will possess the basic knowledge needed to initiate origin inspection under Department of Defense contracts. It is up to the base Environmental Health officer and staff, however, to develop this opportunity and to maintain it as a sound training program.

Benefits. The benefits derived from COLEQUAP are many and varied. If everything in procurement worked as it was supposed to, there would be no need for COLEQUAP; however, Food Service does not always submit Unsatisfactory Material Reports voluntarily and does not always know what characteristics a product is supposed to possess. Also, things do not always work as they are supposed to at origin. Before COLEQUAP, there was no system of reporting either good or bad results of products received at Air Force installations; there was no way to properly evaluate the UMRs submitted on small amounts of product. With COLEQUAP we have a system of providing valuable feedback to management, planning, and procurement agencies. COLEQUAP has resulted in many changes being made to product specifications to insure that the products being procured best fit the needs of the Air Force. Such products as hamburger, bacon, fish portions, grill steaks, and canned hams have been vastly improved due to COLEQUAP feedback. Other actions, such as monetary reimbursements to receiving agencies and product replacement by the contractor due to warranty clause action for latent defects identified during COLEQUAP audits, can be attributed to the COLEQUAP.

Exercises (652):

Indicate whether each statement in items 1 to 5 is true (T) or false (F) concerning COLEQUAP; if any is false, correct it.

___ 1. COLEQUAP does not result in product replacements.

___ 2. COLEQUAP may result in specification changes.

____ 3. COLEQUAP is designed to provide a vehicle for training Environmental Health personnel.

____ 4. COLEQUAP results in proper cooking of food.

____ 5. Valuable feedback is provided to planning, management, and procuring agencies.

653. Identify the responsibilities of various agencies for COLEQUAP; and given statistical date, apply procedures for conducting COLEQUAP to include preparing a sampling plan.

Responsibilities for COLEQUAP. As we have stated previously, many agencies have responsibilities for COLEQUAP. We now discuss these agencies and their responsibilities.

Air Force Engineering and Services Center (AFESC) responsibilities. AFESC selects the issue items to be audited by fiscal quarter. Items are selected primarily on the basis of consumer complaints, previous audit information, and whether items are in a "high cost" category. Each designated item will be audited during a specific month selected by AFESC. If an item designated for audit is not available during a specific month, no audit is conducted.

Inspectors use guidance from two primary sources; the Quarterly Program Notes and the product's specification. AFESC writes the Quarterly Program Notes; the specifications are written by other concerned agencies.

The Quarterly Program Notes contain the applicable portions of the product specification that are to be used for the required audit. They also contain specific inspection requirements, such as tables of examination, paragraph examinations, variable data information, abbreviations that will be used in completing the audit report, multiple choice questions, and other pertinent data. Inspectors are to inspect for, and then to record, only that information called for by the Quarterly Program Notes.

AFESC receives all COLEQUAP reports from the field, analyzes and evaluates these reports, and forwards them to the appropriate agencies with Air Force requests for corrective action or product improvement.

Base-level responsibilities. Base-level responsibilities for COLEQUAP include performing the audit on the required audit item and assisting Food Service in preparing required questionnaires and unsatisfactory material reports. Base-level participants are also responsible for reporting results of the audits through the MAJCOM environmental health officer to AFESC.

Command environmental health officer responsibilities. Command environmental health offices (EHOs) are responsible for validating the accuracy of COLEQUAP reports, forwarding a consolidated report to AFESC, and coordinating with AFESC on command requests concerning food quality.

Other agencies with responsibility include the Defense Personnel Support Center (DPSC), which further pinpoints deficiencies and takes corrective action, such as changes to specifications, inspection procedures, and DPSC storage rotation; and the US Army Natick Laboratory, which provides computer programming capabilities for COLEQUAP, conducts appropriate research, and makes the actual specification changes.

Reference Publications. A thorough knowledge of the following publications is a requirement for the accomplishment of COLEQUAP:

(a) AFR 74-10, *Consumer Level Quality Audit Program* (COLEQUAP).

(b) MIL-STD-105D, *Sampling Procedures and Tables for Inspection by Attributes.*

(c) DSA-DPSC Manual 1455.12A, *Subsistence Computation Guide.*

(d) Quarterly Program Notes for current quarter.

(e) *(Consumer Level Quality Audit Program Handbook (COLEQUAP).*

(f) AFR 400-54, *Reporting of Item and Packaging Discrepancies.*

The *COLEQUAP Handbook,* Published and distributed by AFESC, contains general inspection instructions that are peculiar to the program or that may be different from those procedures used in DPSC procurement inspections. Any applicable tables from MIL-STD-105D, *Guide for Sampling Inspection,* and the Table of Random Numbers, from Handbook H-53, *Guide for Sampling Inspection,* are also included to assist the inspector in developing the sampling plan for the audit and selecting samples for inspection. Quarterly inspection guidance is distributed for each of the primary and alternate audit items.

It is important that food inspectors become well acquainted with the general inspection instructions, specifications, amendments, standards, and other documents referrenced for each audit item. Study each document thoroughly before the start of the inspection. In case of conflict between any of the reference documents, the Quarterly Program Notes are the final authority. Additional clarification of conflicting information can be obtained by phoning AFESC/DEHF.

The handbook contains specific instructions on the completion of the AF Form 2063, Individual COLEQUAP Report. It does so by splitting the pages of instruction into three sections. The *left section* of the handbook page identifies the relative card number from the AF Form 2063. The *center* of each page of the handbook shows the relative column number from the AF Form 2063, and the *right section* of each page explains how to complete the appropriate columns. The handbook also explains how to complete an unsatisfactory material report (UMR) and lists the various reasons for submitting this form.

Sampling Plans and Product Examination. COLE-

QUAP sampling plans are developed from tables in MIL-STD-105D, Sampling Procedures and Tables for Inspectionly Attributes. AFR 74-10 states that a single sampling plan with a normal severity of inspection is used. Remember to check you Quarterly Program Notes for any change to this instruction. Examinations and tests to be performed are stipulated in the program instructions for each audit item. The sampling plan criteria; i.e., levels of inspection, AQLs, expression of lot size, and sample units, are normally the same ones stated in the end item criteria table; this table is normally found in the quality assurance provisions section of the applicable product specification. When developing a sampling plan, do not forget that, if Major A defects are listed in the quality assurance provisions of the specification and no AQL has been specified in that table, then an AQL of 0.0 must be entered on the AF form 2063. You must enter an AQL of 0.0 for each table of examination required by the Quarterly Program Notes when a Major A defect is not assigned an AQL. Again, some criteria may be changed by the Quarterly Program Notes, and you must review the Notes before you proceed.

Before a sampling plan can be extracted from MIL-STD-105D for each AQL, the lot size for the audit must be determined both for the overall audit and for each table of examination. The specification tells you what units you must consider in order to determine lot sizes. Be careful not to confuse the units used for determining lot size with those used to determine sample units; they are often different within the same table of examination. Also be careful to review each table prior to recording a lot size. The number of units that constitute a lot size is the number of units in commissary storage from one contract and lot. As we set up a sampling plan and look forward to the actual examination of the product, we must be familiar with the process of splitting AQLs and calculating the probability of acceptance.

Splitting AQLs. In normal circumstances, when more than one AWL is present in a particular examination, a common sample size is obtained. However, in performing COLEQUAP audits, we must employ the procedure known as "splitting AQLs". "Splitting AQLs" simply means that the inspector uses MIL-STD-105D to determine the sample size for the individual AQLs rather than a common sample size for two or more AQLs. Military Handbook H-53 outlines procedures and gives examples of splitting AQLs. The reasoning behind the practice of splitting AQLs is this: determining a separate sample size for each AQL allows for smaller sample sizes, which reduces the cost of the inspection. A smaller amount of product is inspected, and less time is spent on the inspection. Finally, less product is destroyed during the inspection, which translates into more product for use in the food facility.

In the event that you complete the splitting of your AQLs and one of the sample sizes exceeds your lot size, you are required to do 100 percent inspection of the product for that specific evaluation item identified by the AQL in question. The remaining AQLs are inspected in accordance with the sample size and accept/reject numbers found in MIL-STD-105D. When a Major A defect assumes an AQL of 0.0, the sample size for that AQL cannot be determined, using the previously discussed procedure.

In this latter case, the largest sample size determined for any other AQL in that table of examination will be assigned to the 0.0 AQL. The accept number in this case is always 0.

If the lot size is so small that all assigned AQLs have sample sizes that exceed it, a 100 percent inspection is preformed on the entire examination. When 100 percent inspection must be used and the accept/reject numbers on the AF Form 2063 do not apply, you note this in the remarks section of the AF Form 2063.

Product Examination. Samples must be selected by random sampling technique. Use the table of random numbers or a method equal to it, assuring that each unit in the lot has an equal chance of being selected.

Since COLEQUAP is an audit of Government-owned subsistence at the user level, all foods inspected should be used in the menu. This requires careful planning and close cooperation with food service and commissary personnel. Perform examinations at the commissary warehouse or cold storage plant when possible. Examinations of the product in the thawed or prepared state are accomplished before the item is served in the dining hall. Examine the sample units for all defects listed in the end-item examination requirements found in the Quarterly Program Notes. These examinations are found in the quality assurance provisions of the product specification or the Quarterly Program Notes.

Probability of Acceptance. The probability of acceptance is a statistical means of projecting the quality of the examined lot. In COLEQUAP, probability of acceptance is abbreviated "Pa," and is expressed in gradients from worst to best probability. The worst Pa would be less than, or equal to (≤) 5 percent. The best Pa would be greater than (>) 25 percent. The probability of acceptance should not be confusing, but if confusion does exist, let us explain it here. If the product which we have statistically sampled and inspected has a Pa of less than or equal to 5 percent, we are assuming that the product could be sampled and tested 100 more times and would pass these inspections only five times. In other words, it would fail the inspection 95 times, or have a probability of failure of 95 percent.

Pa's are computed using the tables found in the *COLEQUAP Handbook*. Pa's must be computed for all AQLs for which defects have been found during examination. The exception to this rule would be any AQL which has been expressed as 0.0. You never compute a Pa for an AQL expressed as 0.0.

After computing Pa's for each applicable AQL, select the lowest Pa (worst Pa) determined. This Pa becomes the overall Pa for the audit.

Exercises (653):

1. What agency is responsible for selecting items for COLEQUAP audit?

2. Who is responsible for validating the accuracy of COLEQUAP reports and forwarding the consolidated report to AFESC?

3. What publication contains specific instructions on completion of the AF Form 2063, Individual COLEQUAP Report?

4. In case of conflict between documents required for COLEQUAP, which document takes precedence over all other?

Using supplementary materials (Appendix A, Sampling Plan Tables), determine the sample size and accept or reject numbers for the following, involving items 5 through 8:

	SAMPLE SIZE	*ACC NUMBER*	*REJ NUMBER*
5. Lot Size: 20 Inspection Level: S4 AQLs: 1.5 Major B 4.0 Minor			
6. Lot size: 13 Inspection Level: I AQLs: 1.0 Major B 10.0 Minor			
7. Lot Size: 52 Inspection Level: S3 AQLs: 2.5 Minor B 6.5 Minor			
8. Lot Size: 440 Inspection Level: II AQLs: 4.0 Major 10.0 Minor			

654. Specify the form(s) for reporting COLEQUAP results and publication(s) giving instructions for completing them.

Air Force Form 2063, Individual COLEQUAP Report. Results of COLEQUAP audits are submitted in accordance with AAFR 74-10. This regulation requires that audits be reported to AFESC through the MAJCOM Environmental Health officer on AF Form 2063. The major command will collect all audit reports; screen the data with regard to commodity use, quality, acceptance, and accuracy; and forward them to AFESC. The AF Form 2063 must be completed legibly in pencil. One original copy will satisfy AFESC requirements. Instructions on additional copies must come from the MAJCOM Environmental Health officer. Detailed instructions for completing the AF Form 2063 are found in the COLEQUAP Handbook. These instructions must be followed exactly to insure accuracy. A samplecopy of AF Form 2063, properly completed is shown on figures 4-3 and 14-4.

DD Form 1608, Unsatisfactory Material Report (Subsistence). Subsistence items are considered unsatisfactory when found to be unwholesome or unfit for their intended use. They are reportable if these conditions or factors are beyond normal base control. A food unfit for its intended use may be edible, but the defects may preclude its use as required by the menu. This most often results from failure of the item to meet procurement specification requirements or failure of the specification to protect against the defects or conditions found.

The UMR (DD Form 1608) is prepared and submitted when inspection indicates a Pa equal to or less than 5 percent (< 5%), when the food item is not serving its intended purpose, or when a Major A defect is found for other than packaging or marking defects, or when the marking is missing or illegible. The UMR is to be completed in accordance with with instructions in the *COLEQUAP Handbook* and on the back of DD Form 1608. An example of a properly completed form may be found in figure 14-5.

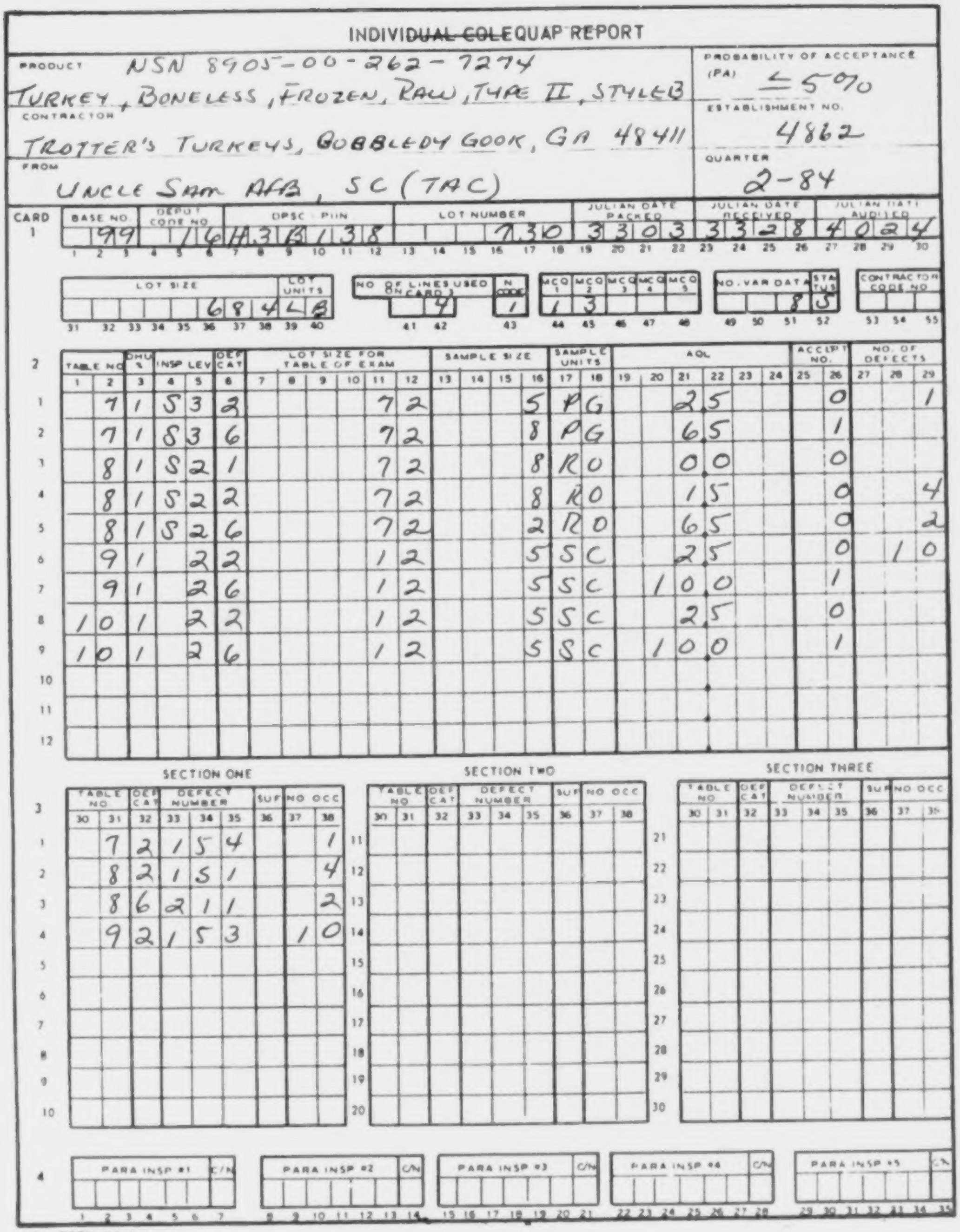
When completing this form, use the product nomenclature from the packing case. Report in block 15 only those tables of examination or paragraph examinations where the product is nonconforming. Nonperishable subsistence has codes that must be cited in block 17 of the form. These codes (A, B, and C) are applied to Government-owned subsistence and can be found in block P of DD Form 1348-1, Single Line Item Release/Receipt Document, which is received with the shipment. The classifications are:

a. A—new material issuable without limitation or restriction.

b. B—new material with limited usefulness or short life expectancy.

c. C—serviceable material for priority issue and normally restricted to CONUS activities.

When completing the UMR, enter in block 17 the date the unsatisfactory material was received at your base and the amount of the product remaining in stock. Attach the completed AF Form 2063 to the UMR. It behooves the initiator of a UMR to be selective in the comments placed in block 18. Phrases such as "Tighten origin inspection" and "Closer surveillance at origin" are of no value. In reality, origin inspectors are limited by MIL-STD-105D and DPSC Inspection Manual 4155.6, (Subsection 225, as to when they can apply tightened inspection procedures. In many instances, the origin inspector did, in fact, provisionally reject the product, but the contracting officer accepted the product with a price adjustment. In other instances because of the procedures of contractor inspection, it is possible that the Government origin inspector did *not* perform verification inspection on the lot that included the unsatisfactory material. It is also possible that the product



INDIVID~~UAL COL~~EQUAP REPORT

PRODUCT NSN 8905-00-262-7274
TURKEY, BONELESS, FROZEN, RAW, TYPE II, STYLE B
CONTRACTOR TROTTER'S TURKEYS, GOBBLEDY GOOK, GA 48411
FROM UNCLE SAM AFB, SC (TAC)
PROBABILITY OF ACCEPTANCE (PA) ≤5%
ESTABLISHMENT NO. 4862
QUARTER 2-84

CARD 1

BASE NO. (1-3)	DEPOT CODE NO (4-6)	DPSC PIIN (7-12)	LOT NUMBER (13-18)	JULIAN DATE PACKED (19-22)	JULIAN DATE RECEIVED (23-26)	JULIAN DATE AUDITED (27-30)
99	16	H3B138	730	3303	3328	4024

LOT SIZE (31-38)	LOT UNITS (39-40)	NO OF LINES USED ON CARD 3 (41-42)	N CODE (43)	MCQ 1 (44)	MCQ 2 (45)	MCQ 3 (46)	MCQ 4 (47)	MCQ 5 (48)	NO. VAR DATA (49-51)	STATUS (52)	CONTRACTOR CODE NO (53-55)
684	LB	4	1	1	3				8	5	

CARD 2

	TABLE NO (1-2)	DHU % (3)	INSP LEV (4-5)	DEF CAT (6)	LOT SIZE FOR TABLE OF EXAM (7-12)	SAMPLE SIZE (13-16)	SAMPLE UNITS (17-18)	AQL (19-24)	ACCEPT NO. (25-26)	NO. OF DEFECTS (27-29)
1	7	1	S3	2	72	5	PG	2.5	0	1
2	7	1	S3	6	72	8	PG	6.5	1	
3	8	1	S2	1	72	8	RO	0.0	0	
4	8	1	S2	2	72	8	RO	1.5	0	4
5	8	1	S2	6	72	2	RO	6.5	0	2
6	9	1	2	2	12	5	SC	2.5	0	10
7	9	1	2	6	12	5	SC	10.0	1	
8	10	1	2	2	12	5	SC	2.5	0	
9	10	1	2	6	12	5	SC	10.0	1	
10										
11										
12										

CARD 3

SECTION ONE

	TABLE NO (30-31)	DEF CAT (32)	DEFECT NUMBER (33-35)	SUF (36)	NO OCC (37-38)
1	7	2	154		1
2	8	2	151		4
3	8	6	211		2
4	9	2	153		10
5					
6					
7					
8					
9					
10					

SECTION TWO

	TABLE NO (30-31)	DEF CAT (32)	DEFECT NUMBER (33-35)	SUF (36)	NO OCC (37-38)
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

SECTION THREE

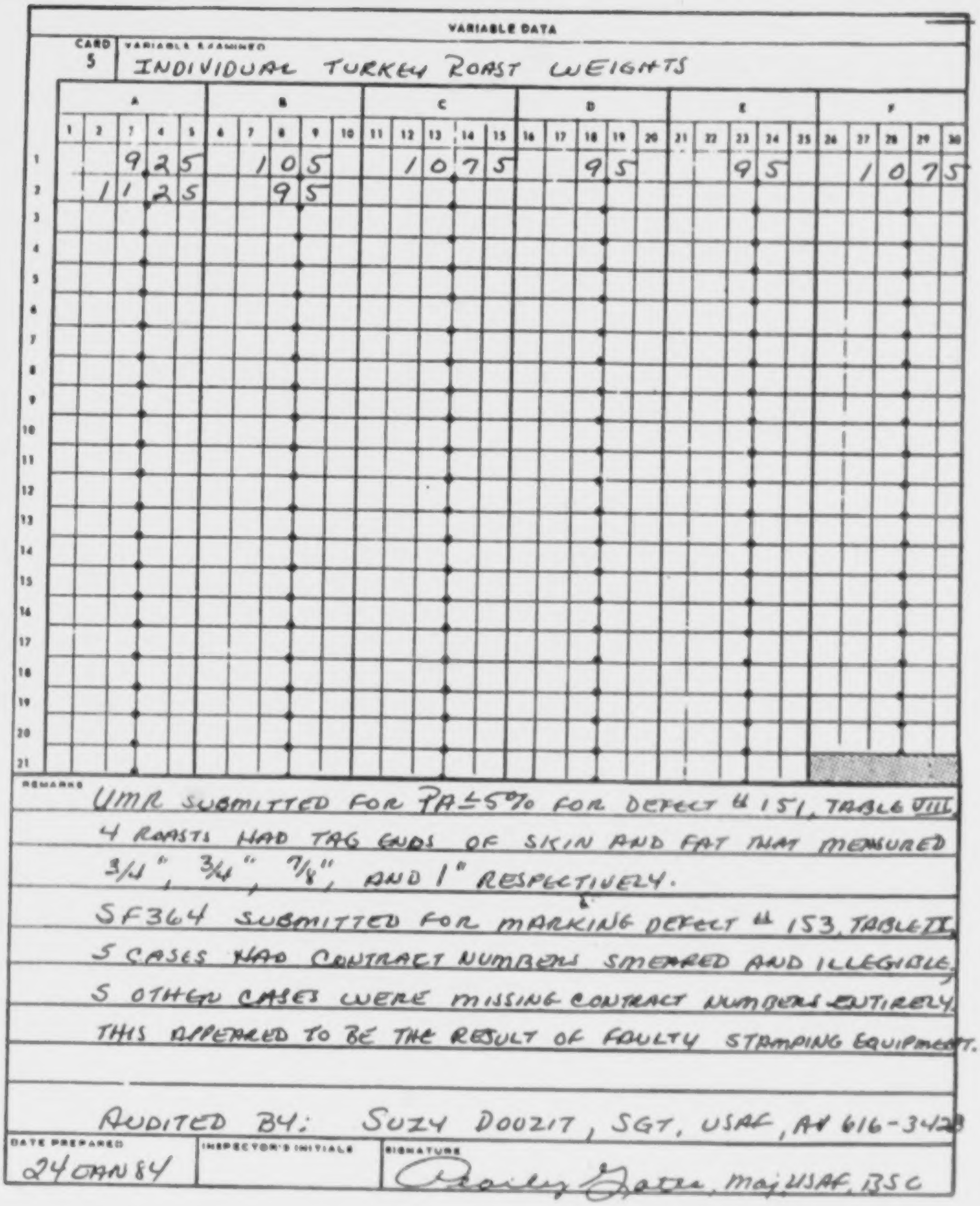
	TABLE NO (30-31)	DEF CAT (32)	DEFECT NUMBER (33-35)	SUF (36)	NO OCC (37-38)
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

CARD 4

PARA INSP #1 (1-6)	C/N (7)	PARA INSP #2 (8-13)	C/N (14)	PARA INSP #3 (15-20)	C/N (21)	PARA INSP #4 (22-27)	C/N (28)	PARA INSP #5 (29-34)	C/N (35)

AF FORM 2063

Figure 4-3 Sample of AF Form 2063.



VARIABLE DATA

CARD
5

VARIABLE EXAMINED
INDIVIDUAL TURKEY ROAST WEIGHTS

	A					B					C					D					E					F				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1			9	2	5		1	0	5			1	0	7	5			9	5				9	5			1	0	7	5
2		1	1	2	5			9	5																					
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
11																														
12																														
13																														
14																														
15																														
16																														
17																														
18																														
19																														
20																														
21																														

REMARKS
UMR SUBMITTED FOR PA≤5% FOR DEFECT #151, TABLE VIII,
4 ROASTS HAD TAG ENDS OF SKIN AND FAT THAT MEASURED
3/4", 3/4", 7/8", AND 1" RESPECTIVELY.
SF364 SUBMITTED FOR MARKING DEFECT #153, TABLE II,
5 CASES HAD CONTRACT NUMBERS SMEARED AND ILLEGIBLE,
5 OTHER CASES WERE MISSING CONTRACT NUMBERS ENTIRELY,
THIS APPEARED TO BE THE RESULT OF FAULTY STAMPING EQUIPMENT.

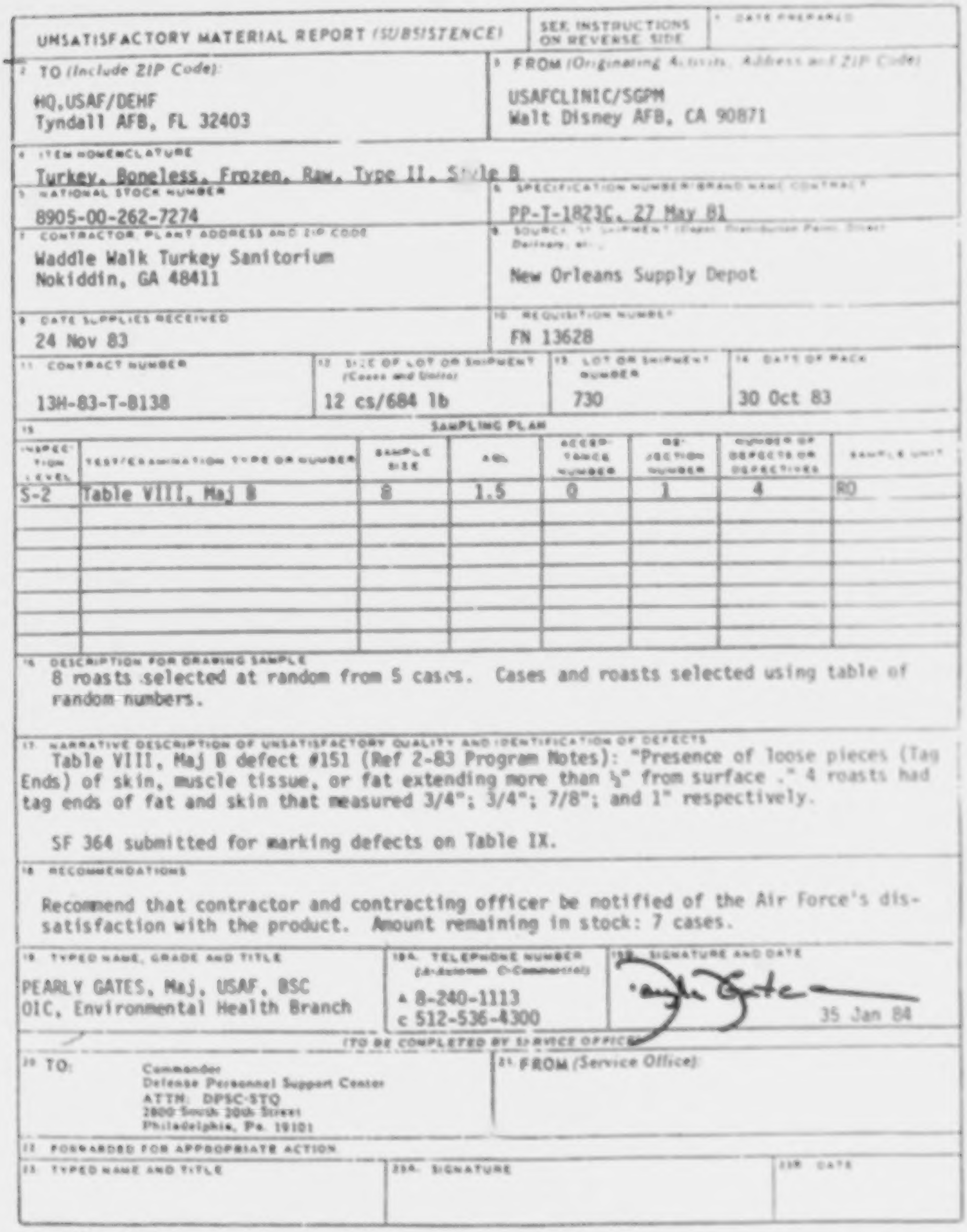
AUDITED BY: SUZY DOOZIT, SGT, USAF, AV 616-3420

DATE PREPARED
24 JAN 84

INSPECTOR'S INITIALS

SIGNATURE
Maj USAF, BSC

Figure 4-4 AF Form 2063 (reverse).



UNSATISFACTORY MATERIAL REPORT *(SUBSISTENCE)*

SEE INSTRUCTIONS ON REVERSE SIDE

1. DATE PREPARED

2. TO *(Include ZIP Code)*:
HQ,USAF/DEHF
Tyndall AFB, FL 32403

3. FROM *(Originating Activity, Address and ZIP Code)*
USAFCLINIC/SGPM
Walt Disney AFB, CA 90871

4. ITEM NOMENCLATURE
Turkey, Boneless, Frozen, Raw, Type II, Style B

5. NATIONAL STOCK NUMBER
8905-00-262-7274

6. SPECIFICATION NUMBER/BRAND NAME CONTRACT
PP-T-1823C, 27 May 81

7. CONTRACTOR, PLANT ADDRESS AND ZIP CODE
Waddle Walk Turkey Sanitorium
Nokiddin, GA 48411

8. SOURCE OF SHIPMENT (Depot, Distribution Point, Direct Delivery, etc.)
New Orleans Supply Depot

9. DATE SUPPLIES RECEIVED
24 Nov 83

10. REQUISITION NUMBER
FN 13628

11. CONTRACT NUMBER
13H-83-T-8138

12. SIZE OF LOT OR SHIPMENT *(Cases and Units)*
12 cs/684 lb

13. LOT OR SHIPMENT NUMBER
730

14. DATE OF PACK
30 Oct 83

15. SAMPLING PLAN

INSPECTION LEVEL	TEST/EXAMINATION TYPE OR NUMBER	SAMPLE SIZE	AQL	ACCEPTANCE NUMBER	REJECTION NUMBER	NUMBER OF DEFECTS OR DEFECTIVES	SAMPLE UNIT
S-2	Table VIII, Maj B	8	1.5	0	1	4	RO

16. DESCRIPTION FOR DRAWING SAMPLE
8 roasts selected at random from 5 cases. Cases and roasts selected using table of random numbers.

17. NARRATIVE DESCRIPTION OF UNSATISFACTORY QUALITY AND IDENTIFICATION OF DEFECTS
Table VIII, Maj B defect #151 (Ref 2-83 Program Notes): "Presence of loose pieces (Tag Ends) of skin, muscle tissue, or fat extending more than ½" from surface ." 4 roasts had tag ends of fat and skin that measured 3/4"; 3/4"; 7/8"; and 1" respectively.

SF 364 submitted for marking defects on Table IX.

18. RECOMMENDATIONS
Recommend that contractor and contracting officer be notified of the Air Force's dissatisfaction with the product. Amount remaining in stock: 7 cases.

19. TYPED NAME, GRADE AND TITLE
PEARLY GATES, Maj, USAF, BSC
OIC, Environmental Health Branch

19A. TELEPHONE NUMBER *(A-Autovon C-Commercial)*
A 8-240-1113
C 512-536-4300

19B. SIGNATURE AND DATE
35 Jan 84

(TO BE COMPLETED BY SERVICE OFFICE)

20. TO:
Commander
Defense Personnel Support Center
ATTN: DPSC-STQ
2800 South 20th Street
Philadelphia, Pa. 19101

21. FROM *(Service Office)*:

22. FORWARDED FOR APPROPRIATE ACTION

23. TYPED NAME AND TITLE

23A. SIGNATURE

23B. DATE

DD FORM 1 DEC 74 1608

EDITION OF 1 MAR 71 MAY BE USED UNTIL EXHAUSTED

Figure 4-5 Sample of DD Form 1608.

was accepted on the basis of the contractor's inspection findings (this happens on skip-lot inspections).

Reporting Inadequacies of Specifications or Subsistence. The following questions are furnished to stimulate the inspector's thoughts when preparing recommendations:

a. Is the product serving its intended purpose?
b. Is the Air Force receiving what it is paying for?
c. Is contractor inspection giving you the quality stipulated in the commodity specification?
d. Is the specification too restrictive as compared to what the dining hall and consumer want?
e. The UMR indicates a noncompliance with specification requirements, but is satisfaction with the product still expressed by the consumer?

Submission of a UMR is also encourages when the product is not serving its intended purpose. That is, the product may be conforming in every respect to specification requirements but may still be unsatisfactory. The ultimate decision in this case rests with food service personnel, based on the product's acceptance by the consumer in the dining hall and on use.

SF 364, Report of Discrepancy (ROD). Packaging, packing, and marking/labeling defects discovered during COLEQUAP audits are reported on SF 364, not DD Form 1608. This form is completed according to instructions found in AFR 400-54. Specifically, when these types of defects are found to have a Pa of less than or equal to 5 percent, or if these defects are scored as Major A defects within the quality assurance provisions of the product specification, then you must report them on the SF 364. The SF 364 serves as sufficient documentation for these types of defects.

As previously stated, COLEQUAP audits are performed on Government-owned subsistence. Thoroughly review your quarterly inspection guidance and determine the amount of the product available in storage. Insure that you have all specifications, clauses, articles, and other documents required for the inspection. Consult and coordinate with the commissary and food service officers on inspection location(s) and dates. Develop your sampling plan before you actually start your inspection. Secure all necessary forms, such as AF Form 2063, DD Form 1608, and SF 364. Follow your sampling plan and select the samples randomly. After completing your inspection, prepare and submit all required correspondence. If you have any problems or questions, contact your command Environmental Health officer or the Air Force Engineering and Services Center (AFESC).

Exercises (654):

1. COLEQUAP audit reports are submitted in accordance with what regulation?

2. On what form are results of COLEQUAP audits reported?

3. Reports of unsatisfactory material are reported on what form?

4. When is an unsatisfactory material report submitted?

5. As well as being completely legible, how must the individual COLEQUAP report be prepared?

6. Through what are reports of COLEQUAP audits reported and to what?

4-5. Operational Rations Inspection

OPERATIONAL RATIONS have been a part of the military feeding system since the Revolutionary War. To protect the health of the troops, inspection for wholesomeness, and, more recently, for quality of the ration components, has been an important part of their production. We in the Environmental Health Service are tasked with this responsibility in the USAF. To assist you in this important task, let's look at what operational rations are available, factors and definitions relating to their deterioration, and finally, the organization and administration of the inspection of the operational ration itself.

Operational rations are used for (1)general, (2) special, and (3) survival feeding situations. The *general feeding* of operational rations is for the military man operating away from conventional field ration supply lines. *Special feeding* applies to a branch of service with a unique feeding problem, such as the problems that the Air Force has with inflight meals or the Army has with its scout patrol feeding. Regarding *survival feeding*, survival food packets fulfill one purpose: sustaining personnel during an emergency. This chapter will give you the information you need to inspect the different types of operational rations.

655. Indicate various types of operational rations available and state when they are used.

Types. The operational rations used in general feeding situations include the Meal, Combat, Individual; and Meal, Ready-To-Eat, Individual. The operational rations used by the Air Force for special feeding situations, such as field exercises and meals on long military flights, include the Food Packet, Inflight Individual; the

Ration Supplement, Sundry Pack; and the Ration Supplement, Beverage Pack. Survival rations that you may have to inspect include the Food Packet, Survival; Abandon Aircraft; the Food Packet, Survival, Aircraft, Life Raft; and the Food Packet, Survival, General Purpose. Other operational rations available include the Food Packet, Survival, Abandon Ship; the Food Packet, Long Range Patrol; and the Ration Supplement, Aid Station. Other operational rations are currently under development and may soon be available. A current list of all rations available or under development may be found in the booklet, *Operational Rations, Current and Future, of the Department of Defense,* published by US Army Laboratories, Natick, Massachusetts 01760.

Exercises (655):

1. Cite two rations used in general feeding situations.

2. Name two rations used by the Air Force in special feeding situations.

3. For what three feeding situations are operational rations used?

656. Identify terms that describe deteriorative changes which may occur in ration components and name the factors that influences deterioration.

Factors Influencing Deterioration. The most important factors influencing the deterioration of rations are time and temperature. Fluctuation of temperaturs—especially repeated freezing and thawing—can accelerate deterioration. Rations stored at low temperatures deteriorate more slowly than do rations stored at high temperatures; however, the composition, quality, and condition of raw ingredients, processing conditions, and packaging will also influence the rate of deterioration. For these reasons various components may deteriorate at different rates.

Terminology of Deteriorative Changes. "Deterioration" refers to the loss of quality due to changes in the normal characteristics of products and packaging. Examples of deterioration are off-flavor, off-color, and loss of packing protection. Other terms that you must be familiar with prior to inspecting rations are explained next.

Unfit for intended use. A meal, packet, or ration is unfit for its intended use when any of the major components are missing, unidentifiable, or deteriorated to the extent that they are considered unpalatable and/or unwholesome, or if the packaging has deteriorated to the point that it no longer affords protection for the product.

Browning. This is a gradual darkening of the product due to a series of chemical reactions between sugar and amino acids. It usually occurs in concentrated food bars and fruit components. It can result in deterioration in flavor, texture, and acceptability of the product.

Liquefaction. This term refers to a degenerative change wherein high sugar foods become syrupy. Liquefaction occurs mostly in jelly bars.

Rancidity. This is a degenerative change in fat producing offensive flavor and odor. Most deteriorative changes in operational rations are not harmful to health but may make the rations unpalatable and their wholesomeness questionable.

Exercises (656):

1. What term describes the loss of quality due to changes in the normal characteristics of products and packaging?

2. What term applies to a gradual darkening of the product due to chemical reactions between sugar and amino acids?

3. What term denotes a meat component which has deteriorated to the point that it is considered unpalatable?

4. What are the most important factors influencing the deterioration of operational rations?

657. Cite a step and specify requirements for inspection of operational rations.

Each individual component that goes to make up the operational ration is inspected and procured in accordance with specifications pertaining to that item alone. The inspection procedures listed n this text are not limited to the individual item but include the entire box or packet. Before studying these inspections, you must understand the terms and definitions used. These terms and definitions are found in AFR 161—19, *Medical Inspection Procedures for Operational Rations,* and in the glossary in the back of this text. Before you perform your inspections, you should become familiar with the necessary publications, forms, and the inspection, disposition, and reporting procedures.

Publications and Forms. The publications used in inspecting operational rations are AFR 161—19, *Medical Inspection Procedures for Operational Rations* Military Standard 105D *Sampling Procedures and Tables for Inspection by Attributes;* and the current *COLEQUAP*

Handbook. The forms to be used are AF Form 2063, DD Form 1608, and SF 364.

Frequency of Inspection. Rations are routinely inspected upon receipt. While in-storage rations are inspected annually after expiration of the original inspection test date (ITD), and then at 6-month intervals, once they have exceeded the expected serviceable storage life. The frequency indicated in Table 13, AFR 161-19, must be used when excessive minor defects are found. The guidelines for increasing the frequency of inspections are discussed later in this chapter. It is impossible to control every factor that influences the rate of deterioration; however, the results of your inspections are used to determine the continued usability of the rations.

Inspection Procedures. The inspection of operational rations will seem familiar to you because you use the same statistical procedurs that you learned earlier in this course. There are, however, some areas in which the procedures are modified somewhat, and there are certain procedures that are peculiar to the examination of rations. Therefore, let this chapter serve you as a refresher for statistical procedures as well as a lesson in their application to the inspection of operational rations.

Identification of the lot. The first step in your inspection is to establish the identification of the lot; this includes determining the lot size. The lot must be homogeneous; that is, it must be made up of product units of the same type and the same contract and lot numbers. These guidelines are used for receipt inspection. For surveillance inspection of rations already owned by the Air Force, products of the same type and year of pack, from one contractor, may be grand-lotted, provided all sublots used have been stored under similar conditions; e.g., lots stored in high-temperature, high-humidity areas should be used rather than taking one lot from the previously described area and another lot from a climate-controlled storage area.

Inspection level. The inspection level to be used for each type of examination is found in AFR 161-19.

Sample size code letter. The sample size code letter is determined from Table 1 of MIL-STD-105D. Do this by matching the lot size with the inspection level that was determined from AFR 161-19. Remember that sample units may be expressed in various ways and that in the inspection of operational rations, you must be familiar with these terms to be sure that you are selecting the correct sample size for your inspections. These terms are as follows:

Primary container. This is the unit container which is in actual contact with the product.

Intermediate container. This is a container of one or more primary containers but must be placed in a master or shipping container.

Shipping container. This is the outer container. It must be a container which is sufficiently strong, by reason of material, design and construction, to be shipped safely.

Sampling plan. Use the double sampling plan in accordance with MIL-STD-105D. AFR 161-19 directs that double sampling always be used for examining operational ratins.

Severity of inspection. AFR 161-19 states that "normal" severity of inspection is to be used unless otherwise directed by the command Environmental Health office.

Determination of the AQL. The AQL for each table of inspection listed in Table 2, for receipt inspection, and Table 7, for surviellance inspection, of AFR 161-19.

Sample Size. Using the correct sample size code letter, extract the sample size from the table for double-normal inspection located in MIL-STD-105D.

Selection of sample units. Before you draw your sample, you will probably ask, "Just what is a sample unit of operational rations?" A *sample unit* is one meal, packet, pack, or accessory packet. Normally, a meal, a pack, or a packet is made up of several components and is packaged in an intermediate container. The contents of the intermediate container make up the sample unit, and each component must be examined for defects. (Be sure that the components from each menu within the lot are equally represented in the sample.) Then select the required number of sample units at random from the lot. When grand-lotting, the sample size must consist of representative units randomly selected from each of the lots. Be sure to maintain the identity of the sample units from each of the lots, because you might have to inspect them separately. You must inspect these sublots individually if you find that one lot contains the majority of defects, or a Major A defect. Record the results of the inspection of each of the lots on a separate AF Form 2063 and handle the disposition of each lot separately.

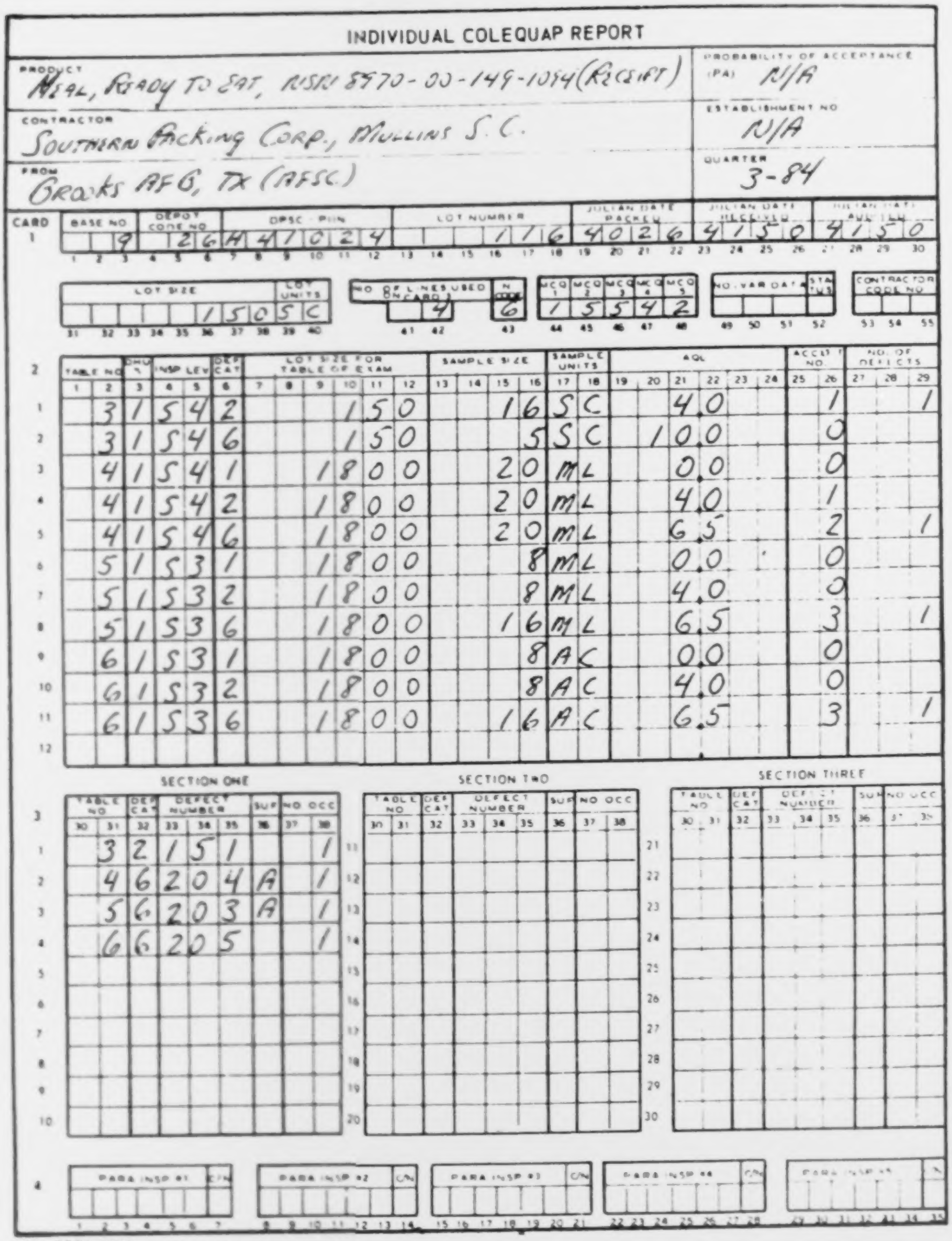
Classifying defects. The categories of defects, classified according to their seriousness, are Major A, Major B, Major, and Minor. Any Major A defect is very serious and is considered to be critical. When one or more Major A defects are found in a sample unit, the lot is considered unacceptable for human consumption. The Major B category represents defects that are likely to result in the rejection of the lot or to reduce the usability of the product for its intended purpose. Minor defects are not likely to reduce the usability of the product for its intended purpose.

Record your inspection data on AF Form 2063 in accordance with the current *COLEQUAP Handbook* Figures 4-6 and 4-7 show a properly completed form.

Accept and reject numbers, abbreviated Ac and Re respectively, are located in Tables II-A through IV-C of MIL-STD-105. You will recall that you determine the acceptance of rejection of a lot by comparing the number of defects with the accept and reject numbers.

Interpretation of Inspection Results, Disposition of Rations, and Processing of Reports. There are several things that must be done after the inspection of a lot. Let's examine each one briefly.

Interpretation of inspection results. To evaluate the lot, you must compare the number of defects actually found with the accept and reject numbers for the appropriate AQL found in MIL-STD-105. A lot is con-



INDIVIDUAL COLEQUAP REPORT

PRODUCT: Meal, Ready to Eat, NSN 8970-00-149-1094 (Receipt)

PROBABILITY OF ACCEPTANCE (PA): N/A

CONTRACTOR: Southern Packing Corp., Mullins S.C.

ESTABLISHMENT NO: N/A

FROM: Brooks AFB, TX (AFSC)

QUARTER: 3-84

CARD 1

BASE NO (1-3)	DEPOT CODE NO (4-6)	OPSC - PIIN (7-12)	LOT NUMBER (13-18)	JULIAN DATE PACKED (19-22)	JULIAN DATE RECEIVED (23-26)	JULIAN DATE AUDITED (27-30)
9	26	H41024	116	4026	4150	4150

LOT SIZE (31-38)	LOT UNITS (39-40)	NO OF LINES USED ON CARD 2 (41-42)	N CODE (43)	MCQ 1 (44)	MCQ 2 (45)	MCQ 3 (46)	MCQ 4 (47)	MCQ 5 (48)	NO. VAR DATA (49-51)	STATUS (52)	CONTRACTOR CODE NO (53-55)
150	SC	4	6	1	5	5	4	2			

CARD 2

	TABLE NO (1-2)	OHU % (3)	INSP LEV (4-5)	DEF CAT (6)	LOT SIZE FOR TABLE OF EXAM (7-12)	SAMPLE SIZE (13-16)	SAMPLE UNITS (17-18)	AQL (19-24)	ACCEPT NO. (25-26)	NO. OF DEFECTS (27-29)
1	3	1	S4	2	150	16	SC	4.0	1	1
2	3	1	S4	6	150	5	SC	10.0	0	
3	4	1	S4	1	1800	20	ML	0.0	0	
4	4	1	S4	2	1800	20	ML	4.0	1	
5	4	1	S4	6	1800	20	ML	6.5	2	1
6	5	1	S3	1	1800	8	ML	0.0	0	
7	5	1	S3	2	1800	8	ML	4.0	0	
8	5	1	S3	6	1800	16	ML	6.5	3	1
9	6	1	S3	1	1800	8	AC	0.0	0	
10	6	1	S3	2	1800	8	AC	4.0	0	
11	6	1	S3	6	1800	16	AC	6.5	3	1
12										

CARD 3

SECTION ONE

	TABLE NO (30-31)	DEF CAT (32)	DEFECT NUMBER (33-35)	SUF (36)	NO OCC (37-38)
1	3	2	151		1
2	4	6	204	A	1
3	5	6	203	A	1
4	6	6	205		1
5					
6					
7					
8					
9					
10					

SECTION TWO

	TABLE NO (30-31)	DEF CAT (32)	DEFECT NUMBER (33-35)	SUF (36)	NO OCC (37-38)
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

SECTION THREE

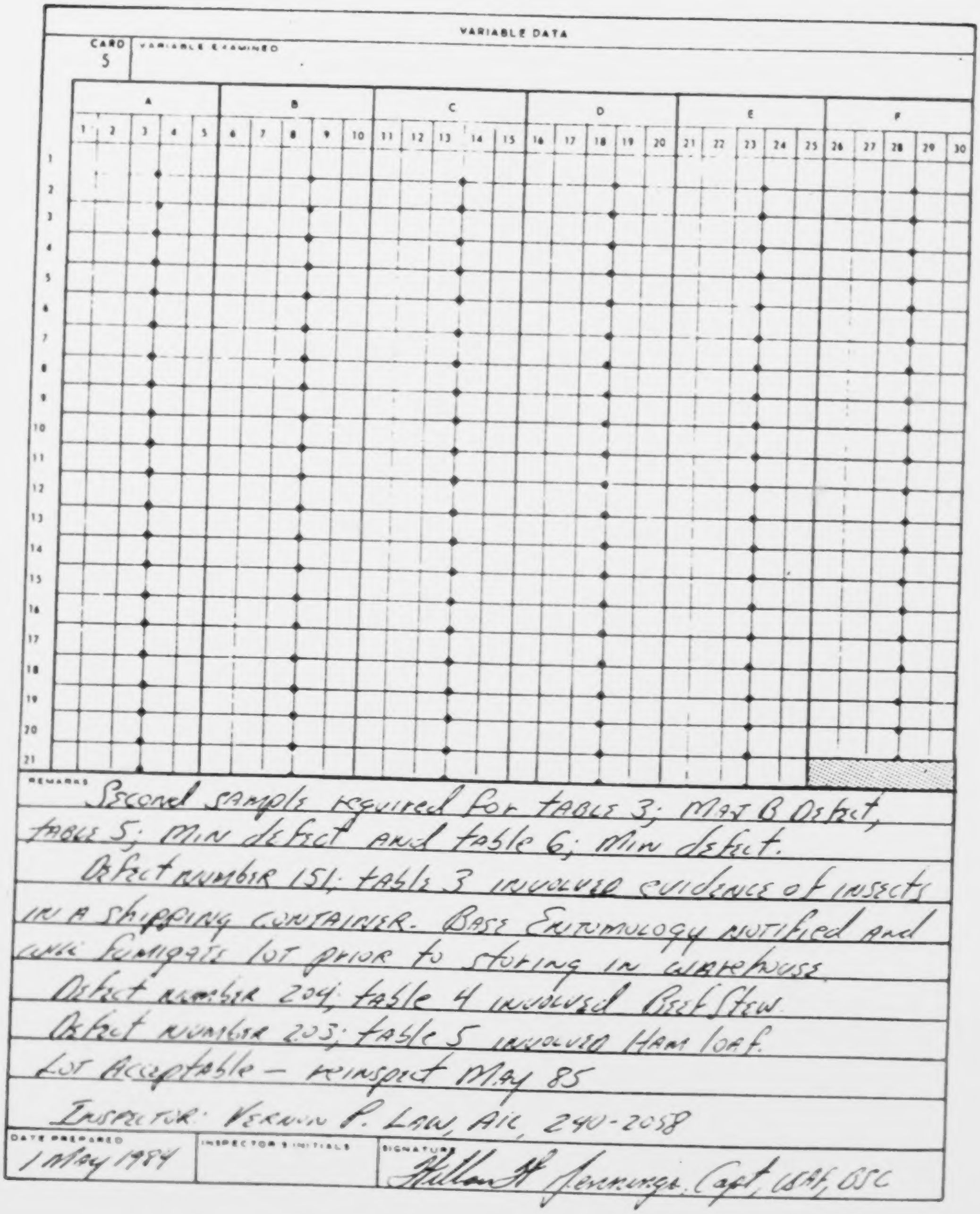
	TABLE NO (30-31)	DEF CAT (32)	DEFECT NUMBER (33-35)	SUF (36)	NO OCC (37-38)
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

CARD 4

PARA INSP #1 (1-6)	C/N (7)	PARA INSP #2 (8-13)	C/N (14)	PARA INSP #3 (15-20)	C/N (21)	PARA INSP #4 (22-27)	C/N (28)	PARA INSP #5 (29-34)	C/N (35)

AF FORM AUG 73 2063 PREVIOUS EDITION WILL BE USED

Figure 4-6 Sample of AF Form 2063. (front).



VARIABLE DATA

CARD: 5

VARIABLE EXAMINED:

A: 1 2 3 4 5 | B: 6 7 8 9 10 | C: 11 12 13 14 15 | D: 16 17 18 19 20 | E: 21 22 23 24 25 | F: 26 27 28 29 30

Rows 1–21

REMARKS

Second sample required for table 3; Maj B Defect, table 5; Min defect and table 6; Min defect.

Defect number 151; table 3 involved evidence of insects in a shipping container. Base Entomology notified and will fumigate lot prior to storing in warehouse.

Defect number 204; table 4 involved Beef Stew.

Defect number 205; table 5 involved Ham loaf.

Lot Acceptable – reinspect May 85

Inspector: Vernon P. Law, A1C, 240-2058

DATE PREPARED: 1 May 1984

INSPECTOR'S INITIALS:

SIGNATURE: Capt, USAF, BSC

Figure 4-7 Sample of AF Form 2063. (reverse).

sidered acceptable for intended use and continued normal frequency of inspection when the number of defects found in each category is less than or equal to the acceptance number. A lot is considered unacceptable when one or more of the following occur(s):

a. One or more Major A defects are found.

b. The cumulative number of defects found (second group of samples) in any Major B defect category equals or exceeds the rejection number.

The action taken after an inspection of rations is not always simply the acceptance or rejection of the lot. There are two other possibilities: immediate rotation or increased frequency of inspections. Let's see how these alternatives are decided.

Rations are acceptable for immediate rotation when the number of defects equals or exceeds the reject number in the Major B defect category. Rations in this category are recommended for immediate in-flight use, for maneuvers and training exercises, and/or for emergency feeding. They are not to be served in the dining halls.

When the number of Minor defects (excluding marking defects) exceeds the reject number of the *first* group of samples, the frequency of inspection increases from once a year to once every 6 months. When the number of minor defects equals or exceeds the reject number of the second group of samples, the inspection frequency increases to every 6 months.

Disposition of rations. When a lot is found to be unacceptable, its disposition must be in accordance with paragraph 6-22, of AFCOMSR 145-2 and AFR 400-54. Include the disposition of the lot in the remarks section of AF Form 2063. It is important that you inform the responsible property officer of all inspection results and of your recommendations about the storage conditions and the estimated storage life remaining.

Processing reports. Forward one copy of the completed AF Form 2063 to your command's Environmental Health officer and maintain a copy for your inspection. The MAJCOM Environmental Health officer will review the report for completeness and accuracy and then forward the report (original) to AFESC/DEHF.

Exercises (657):

1. What is the first step in the inspection of operational rations?

2. When may lots of operational rations be grand-lotted for inspection?

3. What kind of sampling plan is directed by AFR 161-19 to be used for the inspection of operational rations?

4. If one or more Major A defects were found during the inspection of rations, would the lot be acceptable or unacceptable?

5. Operational rations must be inspected using what severity of inspection?

6. What is a primary container?

7. When are rations acceptable for immediate rotation?

4-6. Laboratory Analysis of Subsistence

Your duties as an Air Force food inspector may not involve a great deal of actual laboratory analysis. You will not find yourself surrounded by a horde of bubbling test tubes and multicolored flasks and beakers. What you will most often find yourself doing is collecting foodsamples for shipment to an approved laboratory, where the actual tests will occur. In that light, your required knowledge in this area centers around timely and adequate documentation of samples destined for laboratory analysis.

658. State required information in preparing DD Form 1222.

Preparation of DD Form 1222, Request For and Results of Tests. DD Form 1222 consists of an original and 6 copies. This form, when completed and sent with the sample to be tested and then returned with results annotated, is considered evidence that a sample was submitted and that prescribed testing was performed by an authorized laboratory. It is essential, therefore, that all applicable information be entered on the form. This information will include the number of units represented and the number of units submitted when samples are sent to the laboratory for identification or evaluation, testing, special testing, special request for examination, or production testing. All entries must be typed or neatly printed.

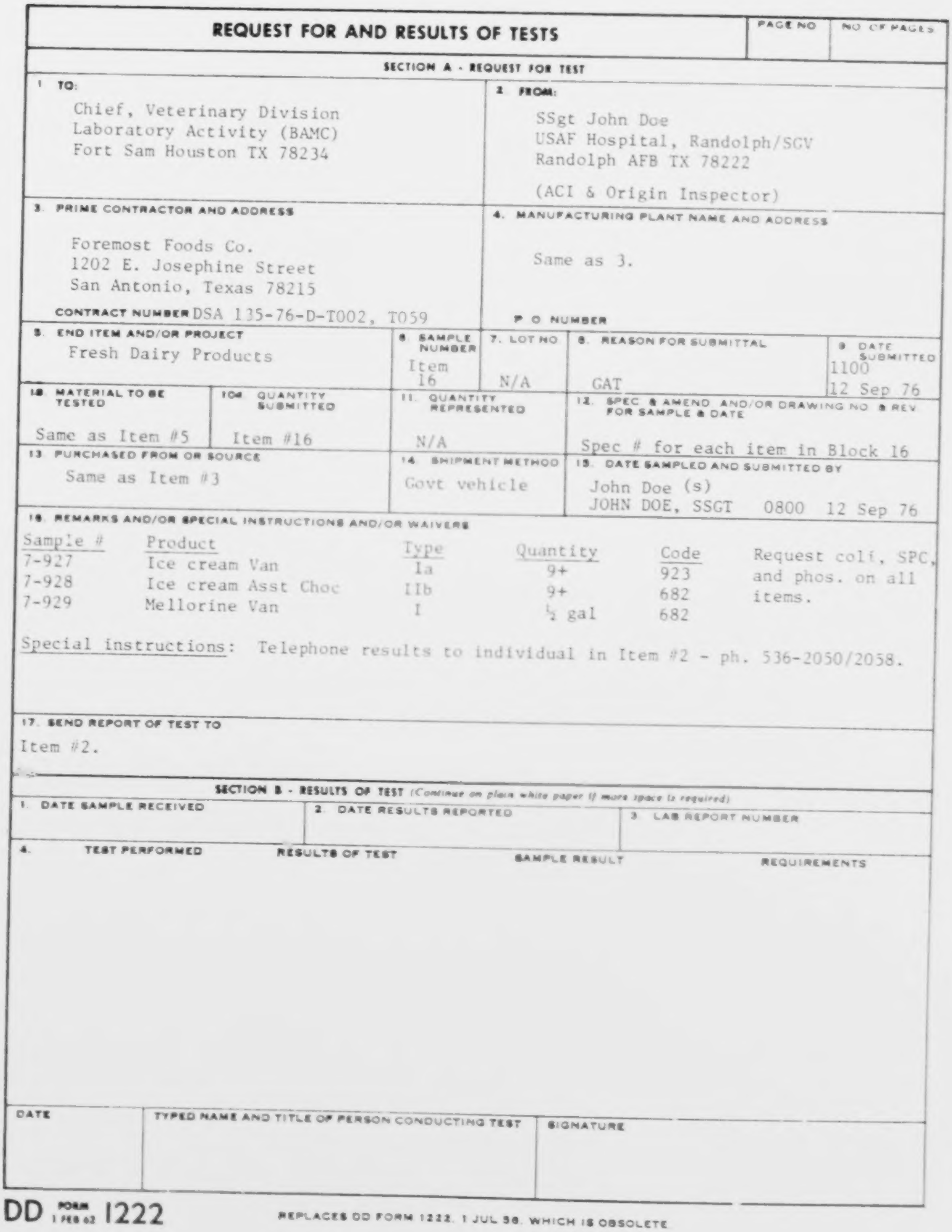
General instructions. The following information is listed on the completed DD Form 1222. You are referred to figure 4-8 and 409 as you study this material.

Block #1. This is the name and address of the laboratory to which the sample is being sent.

Block #2. Enter the QAR's name, rank, and/or symbol and the address and phone number of the QAR's office or base mailing address here.

Block #3. Complete the name and address of the contractor and the contract number as stated in the contract.

Block #4. Enter the name and address of the plant from which the sample is to be submitted. State *the same,* if it is identical to block 3.



REQUEST FOR AND RESULTS OF TESTS

PAGE NO | NO OF PAGES

SECTION A - REQUEST FOR TEST

1 TO:

Chief, Veterinary Division
Laboratory Activity (BAMC)
Fort Sam Houston TX 78234

2 FROM:

SSgt John Doe
USAF Hospital, Randolph/SGV
Randolph AFB TX 78222

(ACI & Origin Inspector)

3. PRIME CONTRACTOR AND ADDRESS

Foremost Foods Co.
1202 E. Josephine Street
San Antonio, Texas 78215

CONTRACT NUMBER DSA 135-76-D-T002, T059

4. MANUFACTURING PLANT NAME AND ADDRESS

Same as 3.

P O NUMBER

5. END ITEM AND/OR PROJECT: Fresh Dairy Products

6. SAMPLE NUMBER: Item 16

7. LOT NO: N/A

8. REASON FOR SUBMITTAL: GAT

9. DATE SUBMITTED: 1100 12 Sep 76

10. MATERIAL TO BE TESTED: Same as Item #5

10a QUANTITY SUBMITTED: Item #16

11. QUANTITY REPRESENTED: N/A

12. SPEC & AMEND AND/OR DRAWING NO & REV FOR SAMPLE & DATE: Spec # for each item in Block 16

13. PURCHASED FROM OR SOURCE: Same as Item #3

14. SHIPMENT METHOD: Govt vehicle

15. DATE SAMPLED AND SUBMITTED BY: John Doe (s) JOHN DOE, SSGT 0800 12 Sep 76

16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS

Sample #	Product	Type	Quantity	Code
7-927	Ice cream Van	Ia	9+	923
7-928	Ice cream Asst Choc	IIb	9+	682
7-929	Mellorine Van	I	½ gal	682

Request coli, SPC, and phos. on all items.

Special instructions: Telephone results to individual in Item #2 - ph. 536-2050/2058.

17. SEND REPORT OF TEST TO: Item #2.

SECTION B - RESULTS OF TEST *(Continue on plain white paper if more space is required)*

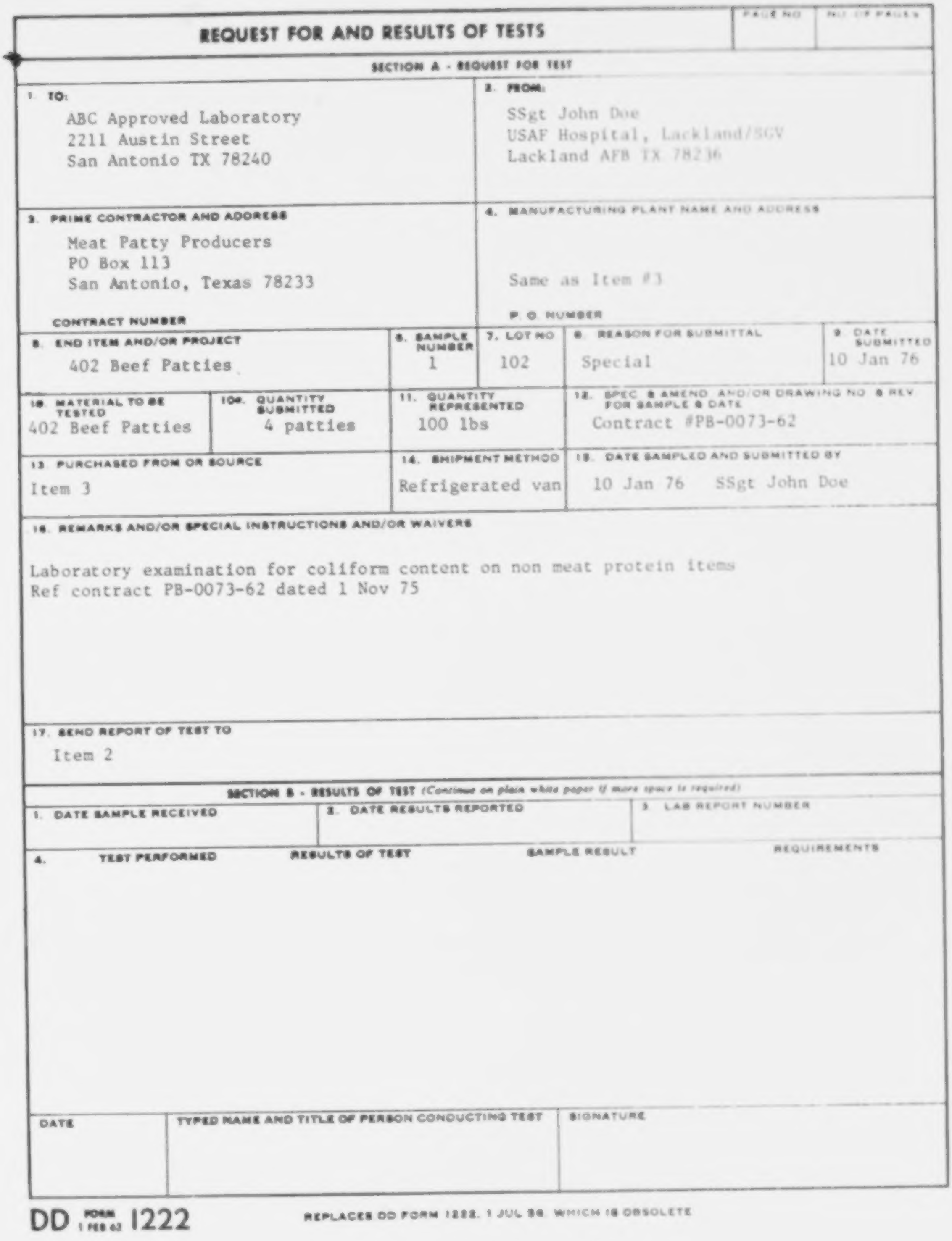
1. DATE SAMPLE RECEIVED
2. DATE RESULTS REPORTED
3. LAB REPORT NUMBER

4. TEST PERFORMED | RESULTS OF TEST | SAMPLE RESULT | REQUIREMENTS

DATE | TYPED NAME AND TITLE OF PERSON CONDUCTING TEST | SIGNATURE

DD FORM 1 FEB 62 1222 REPLACES DD FORM 1222, 1 JUL 58, WHICH IS OBSOLETE

Figure 4-8 Sample of DD Form 1222, multiple items.



REQUEST FOR AND RESULTS OF TESTS

PAGE NO

NO. OF PAGES

SECTION A - REQUEST FOR TEST

1. TO:

ABC Approved Laboratory
2211 Austin Street
San Antonio TX 78240

2. FROM:

SSgt John Doe
USAF Hospital, Lackland/SGV
Lackland AFB TX 78236

3. PRIME CONTRACTOR AND ADDRESS

Meat Patty Producers
PO Box 113
San Antonio, Texas 78233

CONTRACT NUMBER

4. MANUFACTURING PLANT NAME AND ADDRESS

Same as Item #3

P. O. NUMBER

5. END ITEM AND/OR PROJECT 402 Beef Patties

6. SAMPLE NUMBER 1

7. LOT NO 102

8. REASON FOR SUBMITTAL Special

9. DATE SUBMITTED 10 Jan 76

10. MATERIAL TO BE TESTED 402 Beef Patties

10a. QUANTITY SUBMITTED 4 patties

11. QUANTITY REPRESENTED 100 lbs

12. SPEC & AMEND AND/OR DRAWING NO & REV FOR SAMPLE & DATE Contract #PB-0073-62

13. PURCHASED FROM OR SOURCE Item 3

14. SHIPMENT METHOD Refrigerated van

15. DATE SAMPLED AND SUBMITTED BY 10 Jan 76 SSgt John Doe

16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS

Laboratory examination for coliform content on non meat protein items
Ref contract PB-0073-62 dated 1 Nov 75

17. SEND REPORT OF TEST TO

Item 2

SECTION B - RESULTS OF TEST *(Continue on plain white paper if more space is required)*

1. DATE SAMPLE RECEIVED

2. DATE RESULTS REPORTED

3. LAB REPORT NUMBER

4. TEST PERFORMED **RESULTS OF TEST** **SAMPLE RESULT** **REQUIREMENTS**

DATE

TYPED NAME AND TITLE OF PERSON CONDUCTING TEST

SIGNATURE

DD FORM 1 FEB 62 1222 REPLACES DD FORM 1222, 1 JUL 58, WHICH IS OBSOLETE

Figure 4-9 Sample of DD Form 1222, single item.

Block #5. The complete nomenclature of the end item as stated in the contract belongs here. Block 16 may be used as a continuation of this block.

Block #6. Assign sample numbers consecutively for all samples submitted to the government laboratory during the life of the contract.

Block #7. Enter the lot number here.

Block #8. Enter the reason for submitting the sample here.

Block #9. Enter the date the sample is actually shipped to the laboratory here.

Block #10. Enter here complete offical nomenclature of the sample being submitted as an "end item." Block 16 may be used as a continuation of this block.

Block #10a. Enter here the quantity and unit of the sample to be submitted; e.g., cans, pounds, panels, pints, quarts, etc.

Block #11. Enter here the quantity of the component or end item in the lot for the contract. Use block 16 if necessary.

Block #12. Enter here the specification number, date, and amendments or the specific contract number of the item.

Block #13. Enter here the name and address of the supplier.

Block #14. Enter the means of sample transmittal.

Block #15. Enter the QAR's signature and the date the sample was collected.

Block #16. Enter any additional information as required from the blocks.

Block #17. Enter here the address where the report will be sent.

Those areas in Section B of the DD Form 1222 will be completed by laboratory personnel upon completion of required tests.

Specific instructions. Additional more specific instructions for submission of samples of DPSC procured foods are found in the DPSC Subsistence Inspection Manual 4155.6 Subsection 207.1. Remember, however, that the DD Form 1222 can be used in many instances and not only with DPSC procured foods. Use it to submit samples of hamburger for fat analysis to check the calibration of your office's Hobart fat tester. Use it to check on the quality of foods in long-term storage such as operational rations. Use it anytime you want food analyzed beyond the capability of your hospital laboratory. Be sure to forward a copy of the results with your interpretation to the officer or agency responsible for the material from which the sample was taken.

Exercises (658):

1. What does a DD Form 1222 consist of?

2. An annotated DD Form 1222 is considered evidence that a sample was submitted and that what was performed by what or whom?

3. Who completes Section B of the DD Form 1222?

4. How are sample numbered and for how long?

5. Samples were collected on 8 October 1977 and sent to the laboratory on 10 October 19 77. What date is entered in block #9?

659. Indicate the categories in which food is grouped for laboratory analysis and cite examples of instructions for specified food items submitted.

Collection and Submission of Samples. The most common errors made by Environmental Health personnel in collecting and submitting laboratory specimens involve improper labeling and packaging.

To avoid common errors:

a. Label your specimens so that there can be no doubt about their identification when they reach the lab.

b. Use proper and adequate containers. (For example, if your specimen is a liquid, do not assume the container you are placing it in is leak-proof; be certain. Or if the specimen requires a sterile container, it is essential that you make certain not only that it is sterile but also that it is kept sterile when you are collecting your specimen.)

c. Use proper and adequate preservatives and keep your specimens at the proper temperature before packaging.

d. Make certain that your specimens are securely packaged and properly addressed. If the specimen is lost or delayed in mailing, or the primary container is broken or crushed, all of your other painstaking preparations were in vain.

Food samples. Samples of food items submitted for laboratory analyses are grouped into three categories:

a. Those submitted to determine compliance with specification requirements.

b. Those submitted for analyses only for certain specific requirements.

c. Those submitted for other purposes, such as for soundness, estimated storage life, extent of deterioration, fitness for human consumption, detection or identification of foreign material and pathogenic microorganisms.

Look at table 4-1, an excellent guide for preparing specimens for submission to the laboratory. Read this table carefully and conscientiously; it will most certainly increase your knowledge in this area. This table gives you a good idea on how much and how to submit a number of food samples. We must point out, however, that it is only a guide, because laboratories vary in their instructions. You may have specific instructions from the laboratoy in your area that conflict with those in this table. If you do, of course, you must follow your own laboratory's instructions.

Now that you have read table 4-1 carefully, you have discovered that not all of the specimens you may need to collect and submit to the laboratory are included. This is as it should be. Such a table would be nearly impossible to compile and would most certainly be too large to include in this text.

Exercises (659):

1. Name the three categories that foods are grouped into for laboratory analyses.

TABLE 4-1

GENERAL INSTRUCTIONS FOR SUBMISSION OF LABORATORY SAMPLES

SPECIMEN AND TYPE OF ANALYSIS	AMOUNT	INSTRUCTIONS
Bottled fluid dairy products, fresh (includes samples in paper container)	Unopened container (½ pint minimum)	Samples will be submitted in original unopened containers, packed in cracked ice (not dry ice), so that the container remains in an upright position and no liquid reaches the lid or cap. Samples will be delivered to the laboratory as rapidly as is practicable, within 4 hours of the suggested maximum expiration of time between collection and delivery. Temperature of sample should not exceed 40° F.
Bread Chemical	Minimum of 3 slices	Sample should be packed in a sealed plastic bag and placed in a protective outer container or be submitted as an entire unopened loaf.
Bulk fluid and frozen dairy products, fresh Bacteriological, chemical and/or microscopic	Minimum of 200 ml in sterile container (6640 408 9195)	Fluid samples will be treated as bottled fluid dairy products above and frozen desserts will be treated as packaged frozen desserts below.
Butter Bacteriological, chemical and/or microscopic	1 pound in original container or sealed plastic bags.	Samples shall be refrigerated, if submitted during warm weather, and no moisture allowed to enter sample container. If mailed, container 8115-682-6525 will be utilized.
Cheese, natural and process Chemical	½ pound in original container inside of sealed plastic bag	Do not add a preservative. Sample may be shipped unrefrigerated or packed in dry ice (preferred method during hot weather).
Cottage cheese Chemical	Minimum of a 10-gram sample	Submitted in original container or in container 6640-408-9195, or similar container, either refrigerated or preserved with formalin.
Dry milk Bacteriological and chemical	Original container or 1 pound in sterile container	A representative sample should be aseptically submitted to the laboratory.
Evaporated milk Bacteriological and chemical	Two cans from each lot	Packaged to prevent damage during transit.
Flour Chemical	Minimum of 50 grams in original container or container 6640-408-9195	Packaged to prevent damage during transit.
Fluid and frozen dairy products, preservative added Chemical and/or microscopic	Minimum of 120 ml in sterile container (6640-405-6400)	A representative portion of the fluid sample will be used to completely fill the bottle. The frozen sample will be melted and a representative portion placed into the bottle. All bottles shall be checked prior to shipment to insure that no air bubbles are present. Presence of preservative and quantity must be noted on label. The preservative of choice is 1oz of 2% Merthiolate per 120 cc of fluid milk.
Beef, ground or boneless Chemical	1 pound in sealed plastic bag and outer mailing case	Collect portions at regular intervals, regrind with a meat grinder, mix well and place approximately 1 pound in airtight glass container or plastic bags. To prevent decomposition during warm weather, add 2 ml formalin per lb.

TABLE 4-1 (CONT'D)

GENERAL INSTRUCTIONS FOR SUBMISSION OF LABORATORY SAMPLES

SPECIMEN AND TYPE OF ANALYSIS	AMOUNT	INSTRUCTIONS
Oleomargarin	1 pound in original carton or sealed plastic bag	Packaged to prevent damage in transit and if not submitted in original carton, shipped in container 8115 682 6525 for protection of bottle.
Oil, vegetable salad Chemical	One container or 250 ml	Packaged to prevent breakage in transit.
Sausage, bologna frankfurters, liverwurst, pork, and salami Chemical	1 pound or 6 links in sealed plastic bags	Sample will be submitted in a tightly sealed container and, if a preservative is necessary, 2 ml of formalin per lb of sample will be used.
Tomato puree Chemical	1 pint in original container or full container 6640 408 9195	Packaged to prevent breakage in transit.
Frozen dairy products, fresh, frozen Bacteriological, chemical and/or microscopic	Unopened container (½-pt minimum)	Samples will be submitted in original unopened container packaged in dry ice so that the specimens arrive frozen and any insulating material used does not contaminate the specimen.
Homogenized milk, frozen Bacterial, chemical and/or microscopic	Two unopened containers	Specimens will not be allowed to thaw during transit. Two specimens are needed for each sample submitted to enable both bacteriological and chemical analysis.
Lard and shortening Chemical	Minimum of 1 pound in unopened container or sealed plastic bag	Sample should be placed in the glass container tightly sealed and packaged in container 8115-682-6525. Metal containers should not be utilized unless submitted in original unopened container.
Mayonnaise and salad dressing Chemical	Minimum of 1 pint	Submit in unopened original container packed to prevent breakage.
Meat and noodles or meat and spaghetti Chemical	4 ounces in original container	Packaged to prevent breakage in transit.
Milk containers Bacteriological	Sealed container	Submit sealed refrigerated container within 4 hours of collection.

For Exercise 2, a through c, use Table 4-1 as a reference.

2. Give sample submission instructions for the following food items:
   a. Cottage cheese.

   b. Beef ground or boneless chemical.

   c. Mayonnaise.

4-7. Consumer Protection Programs.

One of our functions as food inspectors is to listen to the complaints registered by consumers against particular food items that may or may not be stocked in our local food facilities. We must take each complaint as a serious problem, one worthy of our best effort, rather than appearing to be bored or disbelieving of the complaints registered.

Our final objective segment will explain briefly how we provide protection to the military consumers at our bases.

660. Of the programs available to military consumers for registering complaints with food products, describe the AFCOMS customer complaint program briefly and give the purpose of an ALFOODACT message.

The AFCOMS Customer Complaint Program. AFCOMS, the Air Force Commissary Service, headquartered at Kelly AFB, Texas, seeks to provide military consumers with the best available product for the best available price. At times, this become difficult because of the geography involved with AFCOMS store locations, the ability of Government depots to supply new and fresh subsistence, and the consumers' lack of understanding about the military procurement system. As a food inspector, you are an integral part of the AFCOMS Customer Complaint Program.

When commissary customers experience problems with a product purchased at the commissary, they have the option of returning that product to the store, filling out an AF Form 93, Food Quality REport, and awaiting the outcome of the product analysis, which should be conducted by your food inspection office.

The level of complaint will range form the valid to the unsubstantiated. You need to take each seriously, however, when you investigate it. At the end of your analysis, you complete the AF Form 93 and forward a copy of it to the commissary officer. If the patron requests notification, you should send an official letter to the home address listed on the AF Form 93. If the product is found to be defective, the commissary officer is required to insure that the store and warehouse are surveyed for the defective product. All such defective merchandise must be placed on hold and inspected by the food inspection office. Yor recommended disposition should be followed.

Other Programs. There are several other avenues that may be taken when a defective product is discovered during an inspection or is brought to your attention by a consumer.

Food and Drug Administration. The FDA operates an active investigation branch, one which deals with the same type of consumer complaints we Air Force food inspectors might handle under the AFCOMS program just discussed. When a consumer brings a product to your attention, or if you discover a defective product during your inspectins, you could call the nearest field office of the FDA. This office will record the details necessary to their investigation. Within a few weeks, you will receive a visit from an FDA inspector who will be looking to pick up samples of the alleged defective product for FDA analysis. Yes, you ought to keep samples of the product(s) you believe to be defective. The FDA will investigate the report, and you will receive an answer on the complaint.

ALFOODACT messages. From time to time, Air Force food inspectors may discover food items in the military food chain which pose a potential, or actual, public health danger. When such an event occurs, the food inspection office will issue an ALFOODACT message alerting other commissaries in the Air Force to the potential problem. The ALFOODACT messages you receive are very important documents. They must be logged into your office, i.e., you must record when they were received. You must take the action required in the message. You must keep a close eye in your warehousing and store facilities to insure that no more of the alleged dangers products slip into your food chain during the course of the investigation into the product(s) listed in the ALFOODACT message. When the investigation ends, you are required to follow the disposition instructions on the identified products explicitly.

If you are faced with the possibility of having to issue on ALFOODACT message at your base, you must read and follow the instructions listed in AFR 163-14, *DOD Hazardous Food and Nonperscription Drug Recall System*. This publication will provide you with all of the necessary procedural steps in getting an ALFOODACT message out to the field.

Exercises (660):

1. Describe the Air Force Commissary Systems customer complaint program.

2. What is the purpose of an ALFOODACT message?

Bibliography

Department of Air Force Publications	**Behavioral Objectives**
AFR 74-15, *Quality Assurance Provisions for Fresh Dairy Products, Appendix A.*	622, 623, 624, 625
AFR 161-19, *Medical Inspection Procedures for Operational Rations.*	656, 657, 658
AFR 163-2 *Veterinary Food Inspection.*	644, 645, 646, 647, 648, 649, 650, 651, 652
COLEQUAP Handbook	653, 654, 655
Department of Defense Publications	
DPSC Subsistence Inspection Manual 4155.6.	627, 628, 629, 630 631, 632, 634, 635, 636, 637, 644
DPSC Subsistence Inspection Manual 4155.7.	639, 640, 641, 642
Army/Air Force Exchange Service Publications	
ESM 25-1 *Store Operations.*	643

Glossary

Accessory Packet or Item—The following component of a meal packet will be considered accessory items when not included in a separate packet. Sugar, salt, pepper, tea, soup base, coffee, cocoa, cream, matches, cigarettes, napkins, chewing gum, interdental stimulators, spoon, fork, knife, can opener.

Browning—This is a gradual darkening due to a complex series of chemical reactions between sugars and amino acids. Browning occurs predominantly in concentrated food bars and fruit components. Browning indicates to some degree, the amount of deterioration in flavor, texture, and acceptability which has taken place.

Closed Can Inspection—This is the inspection of canned sample units for external defects.

Component Food Group—This refers to each of the canned components or items in the food packet, such as meat (includes fish, poultry, and mixed meat items), fruit, dessert, or juice.

Defect—Any nonconformance of the unit of product with specified requirements. Defects are normally grouped into critical, major, and minor classes and these classes may be divided into subclasses, such as Major A and Major B.

Defective—This is a unit of product which contains one or more defects. A defective unit of product containing more than one defect is still only one defective.

Deterioration—Loss of quality due to changes in the normal characteristics: flavor, color, odor, appearance, and texture.

Discoloration—Darkening or bleaching of the product.

Flavor, Loss of—Having a metallic, chemical, rancid, stale, fishy, musty, moldy, flat, soapy, burned, scorched, or any flavor that differs from the normal fresh flavor of the product.

Food Packet—A short-term source of nourishment for use in special operational situations.

Homogeneous Lot—A lot whose units are sufficiently alike in all aspects (date of pack and similarity of handling and storage) to reduce probability of great variation. The food packets stored in aircraft and those removed from aircraft may not be homogeneous, but should be grouped as lots insofar as practical and inspected as such.

In-flight Food Packet—A food packet designed for feeding on flights extending over one or more meal periods.

Liquefaction—This is a degenerative change wherein high sugar foods become syrupy. It occurs predominantly in jelly bars.

Loss of Acceptability—This is a change wherein a food loses its normal clean, pleasing flavor and odor. It gradually develops stale, unpleasing tastes, and aromas which may include a mixing of flavors and odors of other food components or packaging materials. This occurs predominantly in the various concentrated food bars; however, it also occurs to a greater or lesser extent in all the food components. Loss of flavor or development of off-flavors to the point where a hungry man will not relish the food is a major defect. Loss of acceptability to a lesser extent is a minor defect.

Lot—The grouping or number of units of a like product to be inspected.

Meal—A nutritionally balanced food unit consisting of approximately one-third of the prescribed daily requirement of a ration.

Nonperishable—Foods that do not require refrigeration during storage and transportation. However, gradual deterioration does occur depending on the storage condition.

Open Can Inspection—This inspection is destructive in the fact that the can cannot be resealed for storage. Inspection is for the inside condition of the container as well as for the product's condition.

Operational Ration—A specially designed nonperishable ration for use during mobilization, combat, emergencies, or any other feeding requirement when forces are operating away from conventional field ration supply lines.

Quality—Quality is based on the number of defects found in the samples inspected.

Ration—Allowance of food for one person for one day. The military has established this to include 3400 calories.

Ration Supplement—A collection of food, beverage, condiment, or comfort items intended to add to the minimum essentials of a specific operational food item in terms of nutrition, palatability, and enhancement or morale.

Rusty Cans—Rust may start from moisture collection (sweating) or corrosion and may eventually penetrate the can. Severe rust includes rust penetration (Pitted Rust).

Sample Unit—The unit of product to be inspected. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The sample unit is not necessarily the same as the unit of purchase, supply, production, or shipment. The inspection documents will stipulate what the sample unit or unit of inspection consists of.

Survival Food Packets—Prepackaged stable foods for use in case of emergency.

Texture, Loss of Normal—Slices and pieces, broken, crumpled, mushy, watery, soft, coarse, tough, stringy, leathery, crisp, hard.

Unfit for Intended Use—A meal, packet, or ration is unfit for its intended use when any of the major components are missing, unidentifiable, or deteriorated to the extent they are considered unpalatable or unwholesome. Also if the packaging material has deteriorated to the extent that it no longer provides adequate protection to the product.

APPENDIX

Appendix A. Sampling Plan Tables

APPENDIX A
SAMPLING PLAN TABLES

Lot or batch size			Special inspection levels				General inspection levels		
			S-1	S-2	S-3	S-4	I	II	III
2	to	8	A	A	A	A	A	A	B
9	to	15	A	A	A	A	A	B	C
16	to	25	A	A	B	B	B	C	D
26	to	50	A	B	B	C	C	D	E
51	to	90	B	B	C	C	C	E	F
91	to	150	B	B	C	D	D	F	G
151	to	280	B	C	D	E	E	G	H
281	to	500	B	C	D	E	F	H	J
501	to	1200	C	C	E	F	G	J	K
1201	to	3200	C	D	E	G	H	K	L
3201	to	10000	C	D	F	G	J	L	M
10001	to	35000	C	D	F	H	K	M	N
35001	to	150000	D	E	G	J	L	N	P
150001	to	500000	D	E	G	J	M	P	Q
500001	and	over	D	E	H	K	N	Q	R

CODE LETTERS

APPENDIX A (CONTD)

Sample size code letter	Sample size	Acceptable Quality Levels (normal inspection)																																																			
		0.010		0.015		0.025		0.040		0.065		0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15		25		40		65		100		150		250		400		650		1000	
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re
A	2	⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		⇩		0	1	⇩		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31
B	3																											0	1	⇧				1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45
C	5																									0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45	⇧	
D	8																							0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45	⇧			
E	13																					0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45	⇧					
F	20																			0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧		⇧		⇧							
G	32																	0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧													
H	50															0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧															
J	80													0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																	
K	125											0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																			
L	200									0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																					
M	315							0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																							
N	500					0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																									
P	800			0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																											
Q	1250	0	1	⇧		⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																													
R	2000	⇧				1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																															

⇩ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.
⇧ = Use first sampling plan above arrow.
Ac = Acceptance number
Re = Rejection number

APPENDIX A (CONTD)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (normal inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	*	⇩	⇩	*	*	*	*	*	*	*	*	*
B	First	2	2														*	⇧		0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31
	Second	2	4																	1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57
C	First	3	3													*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31	⇧
	Second	3	6																1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57	
D	First	5	5												*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31	⇧	
	Second	5	10															1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57		
E	First	8	8											*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31	⇧		
	Second	8	16														1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57			
F	First	13	13										*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧	⇧	⇧			
	Second	13	26													1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27						
G	First	20	20									*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧						
	Second	20	40												1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27							
H	First	32	32								*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧							
	Second	32	64											1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27								
J	First	50	50							*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧								
	Second	50	100										1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27									
K	First	80	80						*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧									
	Second	80	160									1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27										
L	First	125	125					*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧										
	Second	125	250								1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27											
M	First	200	200				*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧											
	Second	200	400							1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27												
N	First	315	315			*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧												
	Second	315	630						1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27													
P	First	500	500		*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧													
	Second	500	1000					1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27														
Q	First	800	800	*	⇧	⇩	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧														
	Second	800	1600				1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27															
R	First	1250	1250	⇧		0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	⇧															
	Second	1250	2500			1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27																

⇩ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
⇧ = Use first sampling plan above arrow.
Ac = Acceptance number
Re = Rejection number
* = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).

DOUBLE NORMAL

App A (3 of 3)

Answers for Exercises

CHAPTER 1

Reference:

600 – 1. a. The smallest unit within the body capable of independent life and function; epithelial, connective tissue, blood, muscle, and nerve.
b. The combination of two or more of the same type of cells bound by connective tissue; epithelial and connective tissue.
A combination of tissues which act together to provide a vital body function; the stomach, heart, liver, and spleen.

600 – 2. (1) f.
(2) h.
(3) c.
(4) h, i.
(5) e.
(6) d.
(7) b.
(8) a.
(9) g.
(10) h, i.

601 – 1. (1) e.
(2) c.
(3) a.
(4) b.
(6) f.
(7) b.
(8) d.
(9) g.
(10) d.
(11) h.
601 – 2. Axial, appendicular, and joints.
601 – 3. Cervical, thoracic, lumbar, sacral, and coccygeal.
601 – 4. Thoracic and pelvic.
601 – 5. The aitchbone.
601 – 6. Striated, smooth, and cardiac.
601 – 7. Voluntary and involuntary.
601 – 8. (a) Tough—outside round, shank, and chuck meat.
(b) Tenderloin, inside rounds.
601 – 9. Central and peripheral.
601 – 10. The mouth, pharynx, esophagus, stomach, and intestines.
601 – 11. Salivary glands, liver, pancreas, and gallbladder.
601 – 12. Blood, heart, and blood vessels.
601 – 13. Pulmonary, systemic, and portal.
601 – 14. Lymph, lymph vessels, and lymph nodes.
601 – 15. The nasal cavity, pharynx, larynx, trachea, bronchi, and lungs.
601 – 16. The urinary and reproductive tracts.

602 – 1. (1) b.
(2) c.
(3) a.
(4) g.
(5) d.

603 – 1. False. The class 2 carcass exhibits these quality characteristics and is most desirable.
603 – 2. True.
603 – 3. False. This is a description of a class 1 carcass.
603 – 4. False. Class is a specification requirement and may be used in a procurement contract.
603 – 5. False. This method is not as accurate as the pizzle eye method and is rarely used today.
603 – 6. True.

604 – 1. USDA Inspected for Wholesomeness.
604 – 2. US Grade.
604 – 3. (a) State of refrigeration and length of storage, (b) age or sex, and (c) manner of cut.

605 – 1. Type I.
605 – 2. Type II.
605 – 3. Form I.
605 – 4. A fillet.
605 – 5. Form IV.
605 – 6. Portions.

606 – 1. Sanitation in the processing plant, wholesomeness of the processed product, and quality grades of the processed product.
606 – 2. That the product is produced in a sanitary plant and was wholesome at the time of inspection.
606 – 3. They must be federally inspected.
606 – 4. That the product was inspected during processing and meets the specification requirements.
606 – 5. To show that the product was inspected for damage, wholesomeness, and quantity prior to shipment.
606 – 6. That the US Government accepts the food because it is wholesome, in good condition, and of the quantity specified.
606 – 7. That the product is fit for its intended purpose.
606 – 8. That the product met the requirements of the specification at the time of inspection.

607 – 1. (1) a.
(2) c.
(3) d.
(4) d.
(5) f.
(6) e.
(7) b.

608 – 1. Fat found on the external surface of the carcass or cut.
608 – 2. One-half inch of surface fat is allowed; pockets may not be more than 1 inch in width.
608 – 3. The fat found naturally around lymph glands and muscle seams that is exposed during fabrication.
608 – 4. One-half inch of seam fat is allowed.
608 – 5. Damaged muscle tissue.
608 – 6. A cut is any trimming error that results in large cuts in roasts and steaks; fractures are any cracks in frozen steaks that exceed ½ of the steaks thickness.

609 – 1. Grade.
609 – 2. As burned-out appearance.
609 – 3. Bruises, scores, and contamination.
609 – 4. Score.

610 – 1. Prime, Choice, Good, Utility, and Cull.
610 – 2. Good muscling in the shoulders, ribs, loin, and rump; high lean to bone ratio; great percentage of the total weight in the more expensive cuts; smooth, tapered body with plump legs.
610 – 3. The firmness of the lean and marbling, feathering, or streaks of fat in the flank muscle.
610 – 4. In accordance with the items from the institutional meat purchase specification for lamb.
610 – 5. The carcass is inspected for a break, or spool, joint; the weight ranges and styles are closely observed; evidence of fecal contamination is looked for; and the fell membrane is examined for signs of water blisters, a slime producer.

611 – 1. (1) m.
(2) g.
(3) v.
(4) x.
(5) i.
(6) p.
(7) t.
(8) n.
(9) q.
(10) j.
(11) c.
(12) s.
(13) d.
611 – 2. Oxidative rancidity.
611 – 3. Three-fourths of an inch.
611 – 4. Souring.
611 – 5. 42° F (6° C).
611 – 6. 10 percent.
611 – 7. 0° F (−18° C).

612 – 1. Conformation.
612 – 2. Freezer burn.
612 – 3. Vestigial feathers.
612 – 4. Broken, disjointed bones, and missing parts.

613 – 1. False. Food and Drug Administration criteria require food additives not reduce action of digestive enzymes.
613 – 2. False. Acids are used to attain a pH that is unacceptable to organisms in food.
613 – 3. True.
613 – 4. False. Antioxidants are added to foods to protect them against oxidation.
613 – 5. True.
613 – 6. False. With a few exceptions, flavor amplifiers are not food preservatives.
613 – 7. True.

614 – 1. (1) a.
(2) c.
(3) b.
(4) d.
(5) f.
(6) e.
614 – 2. a. Overhauling.
b. Pumping.
c. Pumping.
d. Artery.
e. Backpacking.
f. To shorten (decrease) the airing period.
g. To remove moisture to retard bacterial growth, to impart desirable flavors, to stabilize color, to prevent oxidative rancidity, and to kill surface bacteria.
614 – 3. a. Dry salt.
b. A ropy pickle.
c. Touchers.
d. Drys.

615 – 1. Dark cutter.
615 – 2. Callous.
615 – 3. Two-toning.
615 – 4. Sour round.
615 – 5. Bruises.
615 – 6. Spotter.
615 – 7. Abscess.
615 – 8. Mold.
615 – 9. 1/4 inch.
615 – 10. Jugular furrow; diaphragm; ribeye muscle.
615 – 11. Skirt.
615 – 12. Cross grain cut surfaces.
615 – 13. Report to the commissary officer.
615 – 14. 13.
615 – 15. 40° F (4° C).
615 – 16. That the product be rejected.

616 – 1. (1) b.
(2) c.
(3) a.
(4) a.
(5) d.

617 – 1. Odors, tastes, and toxins.
617 – 2. (a) Must be easily opened.
(b) Must be labeled for identification.
617 – 3. One that is 4 + 1/16 inches in diameter and 4 + 12/16 inches in height.
617 – 4. With moisture or meat juices.
617 – 5. To protect the product.

618 – 1. True.
618 – 2. True.
618 – 3. True.
618 – 4. True.
618 – 5. False. Separate cooler rooms should be used for vegetables and eggs.
618 – 6. True.

619 – 1. True.
619 – 2. False. All containers that are placed in freezing temperatures will allow the interior product to freeze.
619 – 3. True.
619 – 4. True.
619 – 5. False. Leaking cans.
619 – 6. True.

620 – 1. (1) c, minor.
(2) a, major.
(3) c, major.
(4) f, not classified.
(5) f, major.
(6) c, major.
(7) b, not classified.
(8) d, not classified.
(9) e, not classified.

621 – 1. (1) e.
(2) d.
(3) f.
(4) c.
(5) f.
(6) a.
(7) b.

622 – 1. True.
622 – 2. False. Only slightly.
622 – 3. False. Oxidation may be accelerated due to oxygen penetration of the dehydrated area.
622 – 4. False. Freezing cannot reverse damage.
622 – 5. False. 45° F for 3 hours.

623 – 1. True.
623 – 2. True.
623 – 3. True.
623 – 4. False. This examination should be performed based upon customer complaints.
623 – 5. False. Normally, the origin inspector will collect samples.
623 – 6. False. This should be done once each month for each line item.
623 – 7. True.

624 – 1. (a) Acceptable and (b) none.
624 – 2. (a) Doubtful and (b) to confirm the oral report with a written warning notice.
624 – 3. (a) Unreliable and (b) the HSC Army veterinarian.
624 – 4. Excellent.
624 – 5. (1) (a) Doubtful, for SPC and butterfat. (b) A warning notice should have been sent out on the second nonconformance for each characteristic, a report for wholesomeness goes to the HSC veterinarian, and a report for quality (butterfat) goes the the contracting officer.
(2) (a) Acceptable and (b) none.
(3) (a) Unreliable and (b) a recommendation that the product be suspended. Also, a report goes to the HSC veterinarian.

625 - 1. In noncompliance. Phosphatase is positive, indicating that a definite health hazard exists.
625 - 2. Invalid, because the proper testing procedure was not adhered to. Another sample should be drawn and sent to the laboratory immediately.
625 - 3. Conforming.
625 - 4. Invalid. A new sample should be collected and sent to the laboratory.

626 - 1. False. The vendor must be listed in the Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement.
626 - 2. True.
626 - 3. False. This facility would not be approved for listing for either of two reasons; critical defect or an SCR of less than 90.
626 - 4. False. It is MIL-STD 668.

627 - 1. (1) AA.
(2) A.
(3) B.
(4) Dirty.
(5) Check.
(6) Leaker.
(7) Loss.

628 - 1. (a) 48.50 pounds. (b) Remove all of the eggs from one end of the case, including the fillers and flats, and weigh them. Multiply this by 2 and subtract 3 ½ pounds for tare weight.
628 - 2. a. Large.
b. Extra Large.
c. Large.
d. Jumbo.
e. Peewee.
f. Peewee.
g. Small.
h. Large.

629 - 1. False. Average internal temperature must not exceed 60° F at destination.
629 - 2. True.
629 - 3. False. Each grade and size must be inspected separately.
629 - 4. False. Four sample cases are inspected on lots containing 42 cases.
629 - 5. True.
619 - 6. False. A 2-percent variation is authorized.

630 - 1. False. In accordance with ESM 25-1.
630 - 2. False. ESM 25-1 is used by AAFES only.

631 - 1. 32° F (0° C).
631 - 2. 29° F and 31° F (−2° C to −1° C).
631 - 3. 85 to 90 percent.

632 - 1. The HSC Directory.
632 - 2. By the nearest military inspection office, normally.
632 - 3. USDA publication.

CHAPTER 2

633 - 1. (1) c.
(2) b.
(3) d.
(4) e.
(5) a.

634 - 1. False. Latent heat is produced as a byproduct of respiration.
634 - 2. False. Fast removal of field heat more favorably sets the color, texture, and flavor.
634 - 3. True.
634 - 4. True.
634 - 5. True.
634 - 6. False. Leafy green vegetables require a high relative humidity of 90 to 95 percent.
634 - 7. True.
634 - 8. False. A refrigerated room full of produce will usually maintain humidity to a satisfactory level.
634 - 9. True.
634 - 10. False. Temperatures below 45° F will cause pitting and dark watery areas on the cucumber after about 10 days of storage.
634 - 11. False. Condensation will collect on fresh fruits and vegetables and establish a breeding place for unwanted mold and bacteria.
634 - 12. True.
634 - 13. True.

635 - 1. b.
635 - 2. a.
635 - 3. a.
635 - 4. c.
635 - 5. a.

636 - 1. False. US standards describe the tolerance for each grade.
636 - 2. True.
636 - 3. False. Articles and clauses furnish additional information and terms for a contract.
636 - 4. True.

637 - 1. False. The procurement agent visits the terminal or local market.
637 - 2. True.
637 - 3. True.
637 - 4. False. This is the written solicitation buying method.

638 - 1. The USDA.
638 - 2. 20,000 pounds or more.
638 - 3. A certificate of conformance.
638 - 4. A USDA inspection certificate.
638 - 5. To identify and condition.
638 - 6. The Government.
638 - 7. Recommend rejection.
638 - 8. The Government may exercise the right to terminate the unexpired portion of the contract.
638 - 9. They must be maintained in a sanitary condition and be capable of maintaining contractual temperature requirements.
638 - 10. At any location and at any reasonable time.

639 - 1. Packaging and storage environment.
639 - 2. To protect the product from damage, contamination, and deterioration.
639 - 3. Humidity, pest infestation, improper sanitation, temperature excesses, and inadequate stock rotation.
639 - 4. Because it, in combination with excessive temperatures, can aid in the growth of molds and bacteria and cause chemical breakdowns that would render foods unfit for intended use.
639 - 5. Sanitation.
639 - 6. Because it aids in preventing foods from exceeding their shelf life while in storage.

640 - 1. To assist the food inspector in making an identification of the product in the container; it is the description of what should be in the container.
640 - 2. To give the food inspector additional reference in indentifying the product; it is the means for identifying a product which may be hard to identify by observation alone.
640 - 3. To notify warehouse personnel and food inspectors that the product requires special handling.
640 - 4. (a) The half moon cresent on the container. (b) Recommend the product for return (you cannot reject product already owned by the Government); it isn't what was ordered.

CHAPTER 3

641 - 1. (1) d.
(2) d.
(3) b.
(4) a.
(5) a.
(6) c.
(7) e.
(8) f.

642 – 1. False. The lowest bids receive contracts.
642 – 2. False. All nonperishable foods are bought by HQ DPSC.
642 – 3. True.
642 – 4. False. The lowest bid is awarded the contract.
642 – 5. True.
642 – 6. True.
642 – 7. False. These are reported to SPE/CQAE.

643 – 1. False. It may use local procurement.
642 – 2. False. This is the base environmental health officer.
643 – 3. False. They are purchased on blanket purchase agreements (BPAs).
643 – 4. False. They must appear on SB 10–500.
643 – 5. True.
643 – 6. True.

644 – 1. (1) b.
(2) f.
(3) c.
(4) a.
(5) g.
(6) h.
(7) d.
(8) j.
(9) i.
(10) e.

CHAPTER 4

645 – 1. 120 days.
645 – 2. 150 days.
645 – 3. $25.00.

646 – 1. On AF Form 1553.
646 – 2. Gross weight.
646 – 3. DPSC Manual 4155.6.
646 – 4. By dividing the sample size into the total amount short.

647 – 1. Identity.
647 – 2. Identity.
647 – 3. Condition.
647 – 4. Condition.

648 – 1. USDA.
648 – 2. USDA.
648 – 3. USPHS.
648 – 4. Military veterinary inspections (US Army).

649 – 1. Class 8.
649 – 2. Class 4.
649 – 3. Condition, identity, and net weight.
649 – 4. The food inspector.
649 – 5. All animal-origin and perishable foods. Nonperishables are only inspected when the NAF facility manager requests such an inspection.
649 – 6. A requirements-type contract calls for an estimated quantity of product to be delivered over a specific period of time; whereas a standard contract calls for a specific amount of product to be delivered on a specific date.

650 – 1. 30 days.
650 – 2. The conveyances in which the supplies were transported and the condition and age of the product.
650 – 3. A DV Form 1608, Unsatisfactory Material Report, submitted to AFESC.
650 – 4. 45° F to 50° F; 0° F.
650 – 5. Class 7 inspections.
650 – 6. Class 9.
650 – 7. A DPSCM 4155.7 inspection.

651 – 1. a, d.
651 – 2. c.
651 – 3. f.
651 – 4. h.
651 – 5. g.

652 – 1. False. COLEQUAP may result in product replacement if the product is still within the warranty period of the contract.
652 – 2. True.
652 – 3. True.
652 – 4. False. COLEQUAP is an audit at the consumer level but has no provisions to insure proper cooking of foods.
652 – 5. True.

653 – 1. The Air Force Engineering and Services Center.
653 – 2. The major command environmental health officer.
653 – 3. The *COLEQUAP Handbook*.
653 – 4. The Quarterly Program Notes.
653 – 5. AQL 1.5 Major B, SS = 8; ACC# = 0; REJ# = 1
AQL 4.0 Minor, SS = 3; ACC# = 0; REJ# = 1
653 – 6. AQL 1.0 Major B, SS = 13; ACC# = 0; REJ# = 1
AQL 10.0 Minor, SS = 5, ACC# = 1; REJ# = 2
653 – 7. AQL 2.5 Minor B, SS = 5, ACC# = 0; REJ# = 1
AQL 6.5 Minor, SS = 8, ACC# = 1; REJ# = 2
653 – 8. AQL 4.0 Major, SS = 50, ACC# = 5; REJ# = 6
AQl 10.0 Minor, SS = 50, ACC# = 10; REJ# = 11

654 – 1. AFR 74–10.
654 – 2. On AF Form 2063, Individual COLEQUAP Report.
654 – 3. On DD Form 1608, Unsatisfactory Material Report (Subsistence).
654 – 4. When Pa ≤ 5 percent of for Major A defect or the product is not serving its intended purpose.
654 – 5. In pencil.
654 – 6. Through MAJCOM EHO; to AFESC.

655 – 1. Meal, Combat, Individual; and Meal, Ready-To-Eat, Individual.
655 – 2. Your answer should contain any two of these three rations: Food Packet, Inflight, Individual; Ration Supplement, Sundry Pack; and Ration Supplement, Beverage Pack.
655 – 3. For general, special, and survival feeding.

656 – 1. Deterioration.
656 – 2. Browning.
656 – 3. Unfit for its intended use.
656 – 4. Time and temperature.

657 – 1. Lot identification.
657 – 2. When the DOP is less than 6 months apart and the rations are of the same type.
657 – 3. Double.
657 – 4. Unacceptable.
657 - 5. Normal.
657 – 6. The container in actual contact with the product.
657 – 7. When the number of defects equals or exceeds the reject number in a Major B defect category.

658 – 1. An original and 6 copies.
658 – 2. That prescribed testing was performed by an authorized laboratory.
658 – 3. Laboratory personnel conducting the test.
658 – 4. Consecutively and for the life of the contract.
658 – 5. 10 Oct 77.

659 – 1. (a) To determine compliance with specification requirements; (b) for analysis for only certain specific requirements; and (c) for other purposes, such as soundness, estimated storage life, extent of deterioration, fitness for human consumption, detection/identification of foreign material, and pathogenic microorganisms.
659 – 2. (a) A 10-gram (minimum) sample, submitted in the original or specified container either refrigerated or in a formalin solution.
(b) A 1-pound sample sealed in a plastic bag with an outer mailing container; a 2-percent formalin solution is added during warm weather; the sample should be finely ground prior to submission.
(c) A 1-pint (minimum) sample in the original container, packed to prevent breakage.

660 - 1. Customers are requested to complete AF Form 93, Food Quality Report, on any food product with which they have a problem. The food inspection office investigates the complaint, completes the AF Form 93, and returns its findings to the commissary officer. The commissary officer must take action on the completed form.

660 - 2. To identify, Air Force wide, food products which have a potential for being, or already are, public health hazards.

1984-544-008/2627 AUGAFS,AL(850454)700

STOP-
1. **MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.**
2. **USE NUMBER 2 PENCIL ONLY.**

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

90850 04 25

FOOD INSPECTION AND TECHNOLOGY

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (600) The primary function of the blood cell is
   - a. to form tissues which will line body cavities.
   - b. the formation of bone, ligaments, and cartilage.
   - c. the formation of a protective covering for the body.
   - d. to remove waste from cells while supplying them with oxygen and food.

2. (600) The function of internal epithelial tissue is to
   - a. line the body cavities and provide protection.
   - b. protect the body by forming hair or skin.
   - c. line the muscles of the body and connect each to the bone.
   - d. protect the body by fighting internal infection.

3. (600) A vertical plane which passes through the vertebral column dividing it into two similar halves is the
   - a. medial plane.
   - b. median plane.
   - c. dorsal plane.
   - d. distal plane.

4. (601) The axial skeleton includes
   - a. the bones of the skull, ribs, sternum, and vertebral column.
   - b. the bones of the pelvic and thoracic limbs.
   - c. the aitchbone.
   - d. the scapula.

5. (601) The fusion point in the middle of a cow's pubis is called the
   - a. sternum.
   - b. sternal rib.
   - c. pericardium.
   - d. aitchbone.

6. (601) The flesh of meat-producing animals is comprised of
   - a. smooth muscle and epithelial tissue.
   - b. epithelial tissue and cardiac tissue.
   - c. connective tissue and smooth muscle.
   - d. striated muscle and some connective tissue.

7. (601) The term used in reference to the point of muscle attachment is the
   - a. origin.
   - b. belly.
   - c. body.
   - d. insertion.

8. (601) Extensor muscles are used by the body to
   - a. operate the cardiac muscle.
   - b. flex the joints.
   - c. operate the nervous system.
   - d. extend or open a joint after flexing.

9. (601) The pharynx is an
   - a. organ which regulates digestion.
   - b. opening to the stomach.
   - c. organ which produces saliva for digestion.
   - d. opening to the esophagus.

10. (601) Select the three subsystems of blood vessels.

   a. Pulmonary, systemic, and portal.
   b. Pelvic, respiratory, and digestive.
   c. Cardiac, spinal, and thoracic.
   d. Pelvic, thoracic, and spinal.

11. (602) The two major muscle types found in poultry are the

   a. cardiac and respiratory.
   b. digestive and reproductive.
   c. flight and walking.
   d. cardiac and reproductive.

12. (602) Air sacs found in the bodies of poultry are used for

   a. bouyancy during flight.
   b. the development of the shell egg.
   c. bouyancy during swimming.
   d. grading the poultry carcass.

13. (603) In beef inspection, class refers to the animal's

   a. health.
   b. weight.
   c. age.
   d. sex.

14. (603) The pizzle eye is used in beef inspection to determine the animal's

   a. age.
   b. sex.
   c. health.
   d. palatability.

15. (604) When discussing poultry, what does the term *type* refer to?

   a. Age.
   b. Sex.
   c. State of refrigeration.
   d. The manner of carcass cut.

16. (604) A poultry carcass marked with a "US Inspected for Wholesomeness" stamp indicates that

   a. the carcass is graded US No. 1.
   b. the carcass has been graded US Grade A.
   c. the production plant is sanitary.
   d. the military will inspect the plant before buying the carcass.

17. (605) When discussing fish procurement for the Armed Forces, the term *type* refers to the

   a. degrees of processing before the item is sold.
   b. method of preservation.
   c. species being procured by the Armed Forces.
   d. style of packaging used to transport the item.

18. (605) Fish portions are a product which are especially bought for

   a. Armed Forces use.
   b. use by mass feeding institutions.
   c. convenient storage and preparation.
   d. Air Force menu planning.

19. (606) Products delivered from a processing plant under USDA plant inspection should bear which of the following inspection stamps?

a. USDA Accepted as Specified Stamp.
b. Partial Inspection Stamp.
c. USDA Wholesomeness Stamp.
d. Destination Inspection Stamp.

20. (606) The Institutional Meat Purchase Specifications (IMPS) are used

a. to outline inspection procedures for destination inspectors.
b. to identify product requirements during USDA inspection.
c. to illustrate universal descriptions of standard meat cuts.
d. as a destination inspection document.

21. (607) How is a product identified when a plant is listed in the *Directory of USDA Approved Plants?*

a. Containers are stamped with a USDA "Product Approved" stamp.
b. Containers are stamped with an establishment number assigned by the USDA.
c. Containers are marked "Approved for Military Purchase."
d. Containers are marked "Sanitarily Produced Product."

22. (607) Usually the most important information placed on a product label is/are the

a. establishment number.
b. ingredients of the product.
c. production date of the item.
d. unit weight of the product.

23. (608) Regarding beef inspection, what does the term bridging refer to?

a. Allowable surface fat measurements.
b Allowable seam fat measurements.
c. Allowable steak fracture measurements.
d. Allowable tag end measurements.

24. (608) In fabricated beef processing, what terms are usually associated with poor workmanship?

a. Bruises and blood clots.
b. Tag ends and fractures.
c. Seam fat and cartilage.
d. Spotters and bruises.

25. (609) Which of the following grading terms is associated with the palatability of the item?

a. Conformation.
b. Finish.
c. Quality.
d. Cutability.

26. (609) Consider this situation. Upon receipt of a shipment of veal carcass, you determine that the internal temperature of the product is 48°F. What should you do?

a. Request disposition instructions from the contracting officer.
b. Recommend rejection of the product.
c. Recommend acceptance with a price adjustment.
d. Recommend acceptance.

27. (610) The lamb carcass must always be inspected for the presence of

a. the diaphragm.
b. the break joint.
c. compensation.
d. rancidity.

28. (611) Your base orders a shipment of chilled US No. 1 pork carcasses. Upon delivery, you observe a pork carcass with thick muscling, low fat-to-lean ratio, and an internal temperature of 38° F. What should you do?

a. Notify the contracting officer and await disposition instructions.
b. Recommend rejection of the product for contract nonconformance.
c. Recommend acceptance of the product with a price adjustment because of the temperature defect.
d. Recommend acceptance of the product.

29. (611) You receive a shipment of chilled pork loins, and during your inspection you determine that the internal temperature of the product is 50°F. What should you do?

a. Accept the product and refrigerate immediately.
b. Accept the product and freeze immediately.
c. Reject the product as unfit for intended use.
d. Notify the contracting officer and await disposition instructions.

30. (612) When determining the quality of poultry, what criterion is used?

a. Weight.
b. Palatability.
c. Conformation.
d. Coloring.

31. (612) In poultry grading, the determination of conformation is based upon

a. fat to lean ratio.
b. skeletal structure.
c. marbling and palatability.
d. weight.

32. (613) What agency should you contact when you have questions concerning the additives in a certain food item?

a. The US Food and Drug Administration.
b. The US Department of Agriculture.
c. The US Public Health Service.
d. US Army Health Services Command.

33. (613) To prevent rancidity in fatty foods, a food processor would place which type of additive in the product?

a. Enzymes.
b. Acids.
c. Antioxidants.
d. Sodium sulfate.

34. (614) The higher grades of pork items being cured will receive which type of pickle?

a. Plain pickle.
b. Standard pickle.
c. Compound pickle.
d. Commercial pickle.

35. (614) What is the term used to describe the injection of curing solution into the interior of a meat item?

a. Overhauling.
b. Second pickle.
c. Wet cure.
d. Pumping.

36. (615) The defect called dark cutter beef is usually determined by examining the

a. rib or loin eye.
b. jugular furrow.
c. diaphragm.
d. break joint.

37. (615) A defect in carcass beef called a sore or scar can result in rejection of the carcass because the

a. defect is caused by bacterial infection.
b. wholesomeness of the product is suspect.
c. appearance detracts from acceptable standards.
d. trimming required will destroy the carcass.

38. (615) One of the first steps a food inspector takes when inspecting food at destination is to

a. contract DPSC for contract information.
b. notify the contracting officer of shipment arrival.
c. take and record the product temperature.
d. net weigh specific items.

39. (615) When determining temperatures during a food delivery, the inspector should select samples using

a. the first boxes seen on the truck.
b. inspection level S-3 and MIL-STD 105D.
c. the sample chart supplied by the contractor.
d. single, normal inspection level and the CLOEQUAP handbook.

40. (616) You receive a shipment of fresh fish at your base and your inspection reveals that rigor mortis has set in these fish. What should you do?

a. Recommend acceptance of the fish.
b. Recommend rejection of the fish for unwholesomeness.
c. Notify the contracting officer and await disposition instructions.
d. Notify the US Department of Commerce of the unwholesome product.

41. (616) What is rigor mortis considered a desirable condition in fresh fish?

a. It makes processing of the fish easier.
b. It sets desired color patterns in fish.
c. It imparts a desired flavor to the fish.
d. It acidifies the fish and prevents bacterial spoilage.

42. (617) Cellophane is used in wrapping meat items because it allows

a. the consumer to see the product.
b. the inspector to see the product.
c. moisture to pass through the wrapping.
d. oxygen to pass through the wrapping.

43. (617) Where would you find the information on required markings for fresh fruits and vegetables delivered to your base?

a. In the DPSC Subsistence Inspection Manual.
b. In the contract for those items.
c. In the USDA Standard for those items.
d. In the Military Standard for those items.

44. (618) You receive a highly perishable frozen food item at your base; the internal temperature of the item is 25°F. What should you do?

a. Recommend rejection of the product.
b. Notify the contracting officer and await disposition instructions.
c. Place the item on stripping in the cold storage area for adequate cooling.
d. Place the item in compact stacks in the cold storage area for adequate cooling.

45. (618) When considering general storage practices, the amount of ventilation required in a storage area depends on the

a. nature of the item being stored.
b. length of time the item will be stored.
c. packaging which protects the item during storage.
d. condition of the item before storage.

46. (619) When food items without packing dates are received in a dry storage area, how should they be handled?

a. They should be returned to the contractor.
b. They should be issued immediately to avoid loss.
c. They should be marked with the date of receipt.
d. They should be marked with an expiration date.

47. (619) Under dry storage conditions, what is the cause of epidemic spoilage?

a. Cockroaches.
b. Rodents.
c. Improper stacking.
d. Container rupturing.

48. (620) A good example of a Minor defect in a can would be a

a. moderate body dent.
b. pin-hole in an end seam.
c. ruptured side seam that is not leaking.
d. excessive swelling without rupture.

49. (620) What action should you take if you discover *spangling* in canned foods?

a. None, it is not a wholesomeness defect.
b. Reject the product for wholesomeness.
c. Report the item to the commissary officer for immediate issue.
d. Report the item to the FDA for investigation of the contractor's processing methods.

50. (621) What does the term *case hardening* mean with reference to canned foods?

a. The product's container has become oil and rigid.
b. The shelving used to store the product is reinforced.
c. The food item has shrunk and dried because of high heat and drying.
d. The food item is leaking onto other containers.

51. (621) What does the term *hard core* refer to in dried foods?

a. Incomplete dehydration resulting in core freezing.
b. Product wholesomeness is no longer acceptable.
c. Improper rotation has left an amount of old product in storage.
d. The contractor's processing methods are inadequate.

52. (622) Freezer burn can accelerate which deteriorative condition in frozen foods?

a. Dehydration.
b. Autolysis.
c. Oxidation and rancidity.
d. Epidemic spoilage.

53. (622) The most important factor when discussing frozen food storage is

a. rotation of stock - first in and first out (FIFO).
b. temperature fluctuation which increases ice crystal size.
c. freezing will not reverse damage which has occurred.
d. bacteria which grow in frozen foods isn't harmful.

54. (623) Who is responsible for submitting dairy samples for laboratory analysis?

a. The origin inspector.
b. The destination inspector.
c. The commissary receiving officer.
d. The contractor at the dairy plant.

55. (623) Correspondence concerning possible deletion of dairy items from a contract is done on

a. DD Form 1222, Request for Testing.
b. DD Form 1232, QAR's Correspondence.
c. AF Form 129, Tally In-Out.
d. HSC Form 0098, Notification of Noncompliance of Fresh or Frozen Dairy Products.

56. (623) Refer to figure 1-16 and figure 1-17. HSC Form 356 is used at destination to document which diary item test?

a. Keeping quality.
b. Net weight.
c. Organoleptics.
d. Product quality history.

57. (623) When is the keeping quality examination for dairy items performed?

a. Each month for each line item.
b. Each delivery for line items specified by the origin inspector.
c. Only when required by the commissary officer.
d. When customer complaints generate a question about the product's keeping quality.

58. (624) The Government inspects a contractor's dairy product on a quarterly basis when the product is considered

a. to have an acceptable degree of reliability.
b new and has no record of reliability.
c. to have an excellent reliability.
d. to have a doubtful reliability.

59. (624) To qualify for a quarterly examination, a contractor's dairy product must meet which basic criteria?

a. Be wholesome and from an approved source.
b. Fail no more than 1 out of 4 tests for any characteristic.
c. Fail no test in four consecutive tests for any characteristic.
d. Be aesthetically acceptable to the consumer.

60. (625) Dairy item analysis at destination is designed to

a. keep contractors from cheating the Government.
b. provide wholesome products to the consumer.
c. prevent illness in a base population.
d. prevent a recurrence of problems which arose during origin inspection.

61. (625) What is the best possible interpretation of a laboratory test on a dairy item, when the sample's temperature at the time of receipt in the lab was 50°F?

a. The test is valid and should be annotated in the quality history records.
b. The test is invalid and shouldn't be entered into the quality history records.
c. The sample should be resubmitted for a second analysis.
d. The test was incorrect and should be ignored.

62. (626) In order to sell dairy items to the military, a contractor's plant must receive a sanitary compliance rating (SCR) of no less than

a. 80.
b. 90.
c. 95.
d. 100.

63. (627) An individual egg may be graded no higher than

a. the lowest quality factor assigned to it.
b. the overall grade assigned to the lot being inspected.
c. the grade requested by the purchaser.
d. the grade required by the contract.

64. (627) The lowest possible grade which can be assigned to an individual egg is

a. Loss.
b. Check.
c. Dirty.
d. Leaker.

65. (628) When weighing eggs using the filler and flat weighing method, what is the tare weight subtracted from a 30 dozen egg case which holds six 30-egg filler flats?

a. 3 1/2 pounds.
b. 3 pounds.
c. 2 pounds.
d. 1 3/4 pounds.

66. (628) To arrive at the *gross weight* for a case of eggs, you must

a. contact the contractor.
b. weigh the entire case, eggs, fillers, and all.
c remove the eggs from the case and weight what's left.
d. weight several cases and divide the overall weight by the number of cases weighed.

67. (629) Acceptance inspection for shell eggs at destination is limited to what criteria?

a. Identity, condition, and count.
b. Temperature, size, and color.
c. Size, condition, and temperature.
d. Count, temperature, and size.

68. (629) The selection of samples for performing destination inspection of shell eggs is based upon the

a. amount graded by the USDA.
b. lot size delivered to you.
c. contract requirement for sample selection.
d. contractor's sample lot delivered with the shipment.

69. (630) AAFES (the Army and Air Force Exchange Service) usually purchases eggs in accordance with

a. brand name requirements.
b. DPSC requirements.
c. the Exchange Service Manual (ESM) 25-1, *Food and Supplies*.
d. local policy set by the contracting office.

70. (631) The two most accepted ways of preparing eggs for long storage is

a. freezing and dehydration.
b. canning and pickling.
c. irradiation and hermetical sealing.
d. oil processing and heat treatment.

71. (631) Processed eggs may be maintained for what period of time while being considered for domestic use?

a. Two months.
b. Three months.
c. Four months.
d. Seven months.

72. (632) A contractor who sells eggs on a locally approved source list may sell to how many military installations?

a. No more than one.
b. No more than three.
c. As many as can be supplied with wholesome product.
d. Only those who have a valid contract with the egg contractor.

73. (633) When discussing the physiology of fruits and vegetables, the term *transpiration* means what?

a. The way in which plants manufacture essential chemicals.
b. The point where the plant begins to produce seeds.
c. The process in which excess water is given off through plant leaves.
d. The process through which essential minerals are absorbed through the plant's root system.

74. (633) What physiological process in a plant continues after harvesting?

a. Ripening.
b. Respiration.
c. Transpiration.
d. Photosynthesis.

75. (634) The best method of ensuring the proper storage of fruits and vegetables is to

a. keep the storage area full at all times to help in maintaining relative humidity.
b. use a controlled-atmosphere storage area for those items.
c. know what storage requirements exist for each specific item.
d. buy nonperishable fruits and vegetables only.

76. (634) The term *vital heat* refers to the heat produced

a. from packing materials, delivery vehicles, and such.
b. by the processing of the ripe fruit or vegetable.
c. by the sun while the fruit or vegetable is growing.
d. as a byproduct of respiration.

77. (635) When inspecting fruits and vegetables, factors such as color and maturity fall under

a. condition.
b. quality.
c. grade.
d. identity.

78. (635) The most commonly encountered physical factor while inspecting fresh fruits and vegetables is

a. heat injury.
b. improper use of chemicals during processing.
c. mechanical injury or damage.
d. spoilage.

79. (636) What is the title of the publication(s) in which definitions of grading terms may be found?

a. The DPSC Subsistence Inspection Manual.
b. The United States standards.
c. The product specification.
d. The master solicitation.

80. (636) The inspection directive which will describe unique product requirements not listed in the product specification is called the

a. master solicitation.
b. United States standard.
c. purchase description.
d. product specification.

81. (637) Usually purchases of fresh fruits and vegetables in excess of 20,000 pounds are made

a. during street buying activities.
b. through written solicitation.
c. during field buying activities.
d. through blanket purchase agreements.

82. (637) Written solicitations for fresh fruits and vegetables are restricted to

a. field buying only.
b. carlot and trucklot buying for overseas use.
c. buying for Government depot storage.
d. street buying only.

83. (638) For shipments of fruits and vegetables of less-than-carlot (LCL) quantity when the amount of the lot is less than $750.00, what form of origin inspection must occur?

a. A USDA inspection of the items is required.
b. An origin inspection by the nearest Army veterinary activity is required.
c. The contractor will inspect the items and supply a Certificate of Conformance (COC).
d. No origin inspection is required on lots this small.

84. (638) At destination products submitted on a Certificate of Conformance will be inspected for

a. condition, identity, and count.
b. all terms of the contract.
c. condition only.
d. wholesomeness only.

85. (639) The most effective long-term control of rodent and insect infestation in a facility is

a. chemical control.
b. biological control.
c. irradiation.
d. sanitation.

86. (639) Regarding non-animal origin foods, the most destructive environment for storage is

a. high humidity.
b. low humidity.
c. low ventilation.
d. low heat.

87. (640) Precautionary markings on shipping containers provide

a. information on storage of the item.
b. warnings concerning stock rotation.
c. information on food additives in the product.
d. warnings concerning unauthorized use of the item.

88. (640) Refer to figure 2-3. The easiest method of identifying foods produced for DPSC depot storage and troop issue use is the

a. National Stock Number printed on the shipping container.
b. precautionary markings applied to all DPSC troop issue products.
c. lot number printed on the shipping container.
d. crescent moon applied to all DPSC troop issue products.

89. (641) Which department of DPSC is responsible for procuring nonperishable subsistence items?

a. HQ DPSC.
b. Defense Supply Region.
c. Augmented Defense Supply Offices.
d. Nonaugmented Defense Supply Offices.

90. (641) What responsibility does a Nonaugmented Defense Supply Office have?

a. Ordering perishable subsistence for government use.
b. Ordering nonperishable subsistence for government use.
c. Administering DPSC requirement-type contracts.
d. Warehousing DPSC owned subsistence.

91. (642) When a car or truckload of perishable subsistence is bid for, what does DPSC consider when choosing the contractor?

a. The lowest bid representing the best value.
b. The best value regardless of performance bid.
c. The contractor who has the best history of performance.
d. The contract requirements and who may meet these best.

92. (642) Food inspectors report DPSC contract nonconformances to

a. HQ USAF.
b. Contract Quality Assurance Element supporting the SPE.
c. Nonaugmented Defense Supply Offices.
d. Defense Contract Administration Service.

93. (643) Local procurement can best be defined as

a. the use of DPSC contracts to buy from local producers of subsistence.
b. purchasing items through the local base purchasing and contracting office (P&C office).
c. a system for buying items that DPSC cannot supply.
d. the use of local contracts to avoid unnecessary delay in supplying subsistence.

94. (643) Under a local purchase contract, who should the destination food inspector notify when nonconformances occur?

a. DPSC/CQAE.
b. Nonaugmented Defense Supply Office.
c. The Base Purchasing & Contracting Officer.
d. Defense Contract Administration Service.

95. (644) Which of the following statements *best* defines the use and importance of contracts in food inspection?

a. Contracts provide the contractor with a means of relief if the government become too demanding.
b. The contract is the sole inspection guide concerning what is to be delivered.
c. No contract is binding upon either party until the time period for performance has ended.
d. The Master Solicitation is the only document in the contract which holds any importance for the food inspector.

96. (644) The most important part of a product specification for the food inspector is the

a. section entitled "SCOPE"; it gives a technical description of what the product is by type, style, etc.
b. section entitled "QUALITY ASSURANCE PROVISIONS"; it tells the inspector what to look for in an end item.
c. section entitled "NOTES", it contains information of a general nature.
d. section entitled "APPLICABLE DOCUMENTS"; it tells the inspector what additional publications have product descriptions.

97. (645) The usual period a supply warranty allows for right of recovery is

a. 60 days.
b. 90 days.
c. 120 days.
d. 180 days.

98. (646) What would be considered a significant shortage while weighing a standard weight item?

a. Any shortage greater than 10% of the total weight of the lot.
b. Any shortage would be considered significant.
c. A shortage which exceeds the Q-Allowance.
d. Any shortage greater than $25.00.

99. (646) While performing general net weight examination procedure, the inspection level required is

a. General I.
b. General II.
c. S-2.
d. S-4.

100. (647) Surveying product containers for inspection stamp marks and lot numbers is a part of inspection for

a. condition.
b. identity.
c. count.
d. contract compliance.

101. (647) Determining whether a product will have sufficient storage life is a part of inspection for

a. condition.
b. identity.
c. count.
d. contract compliance.

102. (648) A food inspector searching for information on which food groups required source approval before delivery should look to

a. AFR 163-9, *Veterinary Laboratory Service*.
b. AFR 161-33, *The Aerospace Medicine Program*.
c. AFR 163-2, *Veterinary Food Inspection*.
d. AFR 163-8, *Control of Foodborne Disease*.

103. (649) A standard contract is a contract which requires

a. a specific amount of product to be delivered on a specific date.
b. brand name item delivery.
c. an estimated amount of product for delivery over a specific period of time.
d. requirements for shipment of subsistence overseas.

104. (649) The determination of nonconformance in a subsistence delivery should be based upon the

a. Army guidance for food inspection.
b. terms of the contract.
c. needs of the receiving facility.
d. attitude of the vendor.

105. (650) Class 6 and Class 7 inspections are primarily performed to do what?

- a. Identify inadequate storage environments.
- b. Determine contract compliance.
- c. Determine the suitability of the stored product for use.
- d. Ensure that adequate transportation vehicles are supplied for shipment.

106. (650) Usually we perform Class 9 inspections at what frequency for semiperishable subsistence?

- a. Within 30 days of receipt.
- b. Monthly.
- c. Within 90 days of receipt.
- d. Semi-annually.

107. (651) When is the DD Form 1234, Report of Inspection of Subsistence Products, used at destination?

- a. When corresponding with receiving officers.
- b. When requesting laboratory analysis of food items.
- c. When recording the dollar value of food inspected.
- d. Only when required by local policy, and when no other form exists.

108. (651) When a food inspector wishes to supply a narrative report on inspection of subsistance, what form is used?

- a. DD Form 1222.
- b. AF Form 2063.
- c. DD Form 1234.
- d. DD Form 1232.

109. (652) The Consumer Level Quality Audit Program (COLEQUAP) provides the Air Force with a system for

- a. analyzing nutrition in dining facilities.
- b. rapid mobilization to wartime readiness.
- c. sending feedback about subsistence to procurement.
- d. ensuring varied and appealing meals to base personnel.

110. (653) When a conflict occurs between a specification and the Quarterly Program Notes, you are required to use

- a. the specification.
- b. DPSC SIM 4155.6.
- c. AFR 163-2, *Veterinary Food Inspection*.
- d. the Quarterly Program Notes.

111. (653) What is the normal sample size for a Major A defect with an AQL of 0.0?

- a. The sample size will be no less than 13.
- b. Usually, the same as the largest sample size for any other AQL in that Table of Examination.
- c. No more than the sample size for all other Major A defect AQLs in that specific audit.
- d. The sample size will be one because there is no value for that AQL.

112. (654) During COLEQUAP Audits DD Form 1608, Unsatisfactory Material Report, is submitted for which defects?

- a. Defects which involve packaging, packing, and marking of sample units.
- b. All defects found during a COLEQUAP audit.
- c. Defects which indicate an overall probability of acceptance equal to or less than 5%.
- d. All Major B defects listed in the Quarterly Program Notes.

113. (654) If you should doubt that a food item is serving its intended purpose, which of the following should you do?

- a. Recommend to AFCOMS that the item be dropped from their supply requests.
- b. Reject the item when it is delivered to your base.
- c. Contact the Air Force Engineering and Services Center (AFESC).
- d. Request a special COLEQUAP audit on the item.

114. (655) The operational ration, Meal, Combat, Individual; is used in which of the following situations?

a. General feeding.
b. Special feeding situation for the Air Force.
c. Survival feeding.
d. Other operational feeding.

115. (656) The most important factors influencing the deterioration of rations are

a. humidity and date of pack.
b. packaging and packing.
c. time and temperature.
d. storage area and pest infestation.

116. (656) Usually an operational ration which is considered unpalatable and has damaged packaging is termed

a. unfit for its intended use.
b. rancid.
c. a "Critical" defect.
d. an immediate issue item.

117. (657) After an instorage ration has exceeded its original inspection test date, it must be inspected at what frequency?

a. Every month until issued.
b. Once a quarter.
c. Every six month until issued.
d. Once a year.

118. (657) When grand-lotting for operational ration inspections, the sample size must consist of

a. at least one unit from every lot in storage.
b. units which represent all lots received in that quarter.
c. three units from every lot in storage.
d. selected units from lots presently being issued.

119. (658) A completed DD Form 1222 is considered evidence that

a. the food inspection office is performing prescribed duties.
b. all samples are legally collected and necessary.
c. sample are not being maintained in the food inspection office.
d. samples were submitted and prescribed tests were done.

120. (658) If you want specific instructions for completing the DD Form 1222, Request for and Results of Tests, you'd look to which of the following publications?

a. AFR 163-2, *Veterinary Food Inspection.*
b. AFCOMSR 145-2, *Store Operations.*
c. DPSC Subsistence Inspection Manual.
d. AFR 161-19, *Medical Inspection of Operational Rations.*

121. (659) To avoid some common errors in sample submission to the tab, what should you do with the samples?

a. Label each sample to identify it for lab personnel.
b. Mail samples by express mail to avoid damage.
c. Perform all lab tests at your base.
d. Freeze them to avoid temperature fluctuation.

122. (660) When a defective product is discovered during investigation of a customer complaint, the commissary officer must

a. notify all store patrons of the problem.
b. publish an immediate recall notice on the item.
c. check the store and warehouse to place the item on hold.
d. destroy all stock of the item immediately.

END OF EXERCISE

MAIL TO: ECI, GUNTER AFS AL 36118-5643

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012. PRINCIPAL PURPOSE: To provide student assistance as requested by individual students. ROUTINE USES: This form is shipped with ECI course package, and used by the student, as needed, to place an inquiry with ECI. DISCLOSURE: Voluntary. The information requested on this form is needed for expeditious handling of the student's inquiry. Failure to provide all information would result in slower action or inability to provide assistance to the student.

I. CORRECTED OR LATEST ENROLLMENT DATA

1. THIS REQUEST CONCERNS COURSE (1-6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER

5. SOCIAL SECURITY NUMBER (7-15) ___ ___ ___ - ___ ___ - ___ ___ ___ ___

6. GRADE/RANK

7. NAME *(First initial, second initial, last name)* (17) – (18) – (19-32)

8. ADDRESS
OJT ENROLLEES Address of unit training office with zip code.
ALL OTHERS Current mailing address with zip code.
(33-53)
(54-75)

9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE

10. TEST CONTROL OFFICE ZIP CODE/SHRED (33-39)

II. REQUEST FOR MATERIALS, RECORDS, OR SERVICE

X *Place an 'X' through number in box to left of service requested.*

1 Request address change as indicated in Section I, Block 8.

2 Request Test Control Office change as indicated in Section I, Block 10.

3 Request name change/correction. *(Provide Old or Incorrect data here)*

4 Request Grade/Rank change/correction.

5 Correct SSAN. *(List incorrect SSAN here.)* *(Correct SSAN should be shown in Section I.)*

6 Extend course completion date. *(Justify in "Remarks")*

7 Request enrollment cancellation. *(Justify in "Remarks")*

8 Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 10
Originals were: ☐ Not received ☐ Lost ☐ Misused

9 Send course materials. *(Specify in "Remarks")*
☐ Not received ☐ Lost ☐ Damaged

10 Course exam not yet received. Final VRE submitted for grading on ____________ (date).

11 Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 10 not yet received.
Answer sheet(s) submitted ________________ (date).

12 Results for CE not yet received. Answer sheet submitted to ECI on ____________ (date).

13 Previous inquiry (☐ ECI Fm 17, ☐ ltr, ☐ msg) sent to ECI on ____________ (date).

14 Give instructional assistance as requested on reverse.

15 Other *(Explain fully in "Remarks")*

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16 G	33	
K	VOL 33-35	GR 36-38
M	33-34	35-40
N	33- 35	
P	VOL 33-35	
	TC 36-37	38
	DOE 39-45	
Q	33-34 00	38 1
	MC 39-42	

REMARKS *(Continue on reverse)*

OJT STUDENTS must have their OJT Administrator certify this record.

ALL OTHER STUDENTS may certify their own requests.

I certify that the information on this form is accurate and that this request cannot be answered at this station.

SIGNATURE

ECI FORM 17 DEC 84 PREVIOUS EDITION WILL BE USED

SECTION III: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

VRE Item Questioned:

Course No ________

Volume No ________

VRE Form No ________

VRE Item No ________

Answer You Chose ________ (Letter)

Has VRE Answer Sheet been submitted for grading?

☐ Yes ☐ No

REFERENCE

(Textual reference for the answer I chose can be found as shown below)

In Volume No ________

On Page No ________

In ☐ left ☐ right column

Lines _____ Through _____

MY QUESTION IS:

REMARKS

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. Course workbooks have a Form 17 printed on the last page.

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CDC 90850

ENVIRONMENTAL MEDICINE SPECIALIST

(AFSC 90850)

Volume 5

Medical Readiness

Extension Course Institute
Air University

556

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Preface

THIS FIFTH volume of CDC 90850 was written to describe the purpose and scope of medical readiness and your responsibilities for disaster preparedness as an Environmental Health Specialist. Aside from acute medical problems, food and water will be one of the most urgent problems following a special weapons (nuclear, chemical, and biological) attack upon our nation. Realizing the vital importance of safe food and water resources in maintaining a high degree of effectiveness, you must be aware of some of the key factors involved. Of even greater importance is how these problems can be properly assessed in order to continue to maintain our high degree of combat effectiveness under wartime conditions. The information presented in this volume will help you protect and decontaminate food and water and prepare you to support the medical mission in both peacetime disasters and wartime situations.

Chapter 1 is an introduction to medical readiness. It discusses what medical readiness is, the various types of disasters, and what you must do should a disaster occur.

In Chapter 2 you will read about natural disasters and their effects. Chapter 3 covers all the aspects of nuclear warfare: its effects; how to detect radiation; how to protect yourself and others; and lastly, how to decontaminate food contaminated with radioactive materials. Chapter 4 is about biological warfare. In it we discuss how biological agents may be introduced into our environment and personal protective measures. Chapter 5 covers chemical warfare: how to detect chemical agents and decontaminate personnel and food.

For easy reference, Appendix A lists the various NBC detection equipment, and Appendix B is a chemical agent reference list. Refer to them as directed in the text and use them as references for your own disaster preparedness program at your base.

A glossary of terms used in this course is included at the end of this volume.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

This volume is valued at 18 hours. (6 points). Material in this volume is technically accurate, adequate, and current as of August 1984.

Acknowledgement

PREPARATION of this volume was aided through the generous cooperation and support of the Battlefield Medical Operations Branch, USAFSAM. They furnished many reference materials such as tables, illustrations, and up-to-date technical information concerning the effects of nuclear, biological, and chemical warfare. Without their assistance we could not have presented the state of the art of medical readiness within the scope of modern battlefield medical operations.

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CHAPTER 1

Introduction to Medical Readiness

ALTHOUGH people have made tremendous technical progress in a relatively brief existence on earth, humans are still virtually helpless against the elements of nature. Natural disasters, such as floods, hurricanes, volcanoes, and earthquakes, continue to cause much loss of life, suffering, and property damage. As if the misery caused by these disasters is not enough, we are also forced to contemplate the innovation of war, an added disaster which multiplies suffering and death.

In peacetime, mankind—through ignorance, carelessness or design—uses explosives, fire, and other tools of destruction to bring havoc and ruin to the human species. During war, weapons are created with such destructive magnitude that survival itself is now questionable.

1-1. Purpose and Scope of Medical Readiness

If such weapons are employed in a future war, the Air Force Medical Service will be called upon to manage unique medical problems. Your knowledge of the medical effects and proper response for these various weapons is the foundation for the effective management of casualties. First, we will discuss medical readiness in its basic form—what does the term mean, the types and stages of disasters, and what are your responsibilities during such situations.

800. State the purpose for medical readiness and the types and stages of disasters.

Definition of Medical Readiness. Medical readiness can be defined as being "ready to perform our medical mission under any circumstances: natural disasters, major accidents, or even warfare." This readiness can only be accomplished by planning in advance for that occurrence. Planning for medical operations is a dynamic process that must consider the overall military mission, the potential peacetime and wartime situations which might occur, and the medical resources that would be available. Planning is vital because it sets up the organization and procedures required to successfully accomplish patient care and any related medical support tasks that would be expected in a disaster situation. Realistic planning provides the commander with the necessary basic information needed to make the best use of available resources. The term "disaster" usually refers to the environment in which mass casualties occur. We will group disasters in two general categories: peacetime and wartime disasters.

Peacetime disaster. This term describes nonwartime, casualty-producing events. Usually, the more severe the occurrence and the larger the population, the more casualties will occur. The surrounding populations may not be directly affected by the disaster, and may provide outside assistance to the disaster site. Examples of peacetime disasters include fires; floods; earthquakes; tornadoes; riots; nuclear, biological, or chemical (NBC) accidents; and other major accidents and incidents.

Wartime disaster. Wartime disasters are environments that exist when conventional or NBC weapons are employed by an enemy to cause large numbers of casualties.

Stages of disasters. There are seven basic stages of disasters. The following is a description of each stage in the order it occurs.

(1) Warning stage—Communication is of great importance to assure that the public hears and understands.

(2) Threat stage—With specific local danger, people act individually as the threat arrives.

(3) Impact stage—People deal with their own disaster. Survival is the most action anyone takes.

(4) Inventory stage—People define what has happened, where do they go, what can they do to assist.

(5) Rescue stage—This is the first opportunity that an outside organization has some effect. The impact area is defined at this time and a fringe area, which is recognized by thrill seekers, vandals and others, develops. Outside of the fringe area is established a filter area to secure the impact area. Outside of the filter area is the relief area which could be a neighboring town or country, depending on the size of the disaster (fig. 1-1).

(6) Remedy stage—This is a period of reorganization and transition.

(7) Recovery stage—Equilibrium has been established.

There are three types of groups working following disasters in addition to what individuals are doing for themselves. There is the spontaneous, self-help type providing immediate response; there are local agencies to deal with disasters, such as the Red Cross; and there are those activities which are external to the disaster and which can lend objectivity and discipline to the project, but are looked on as "outsiders."

You can fit each of these roles, depending on your involvement in a recovery operation and the proximity of the disaster to your home. You should prepare yourself to provide what help you can. As this course will illustrate, you can contribute in many areas. Keep in mind that as

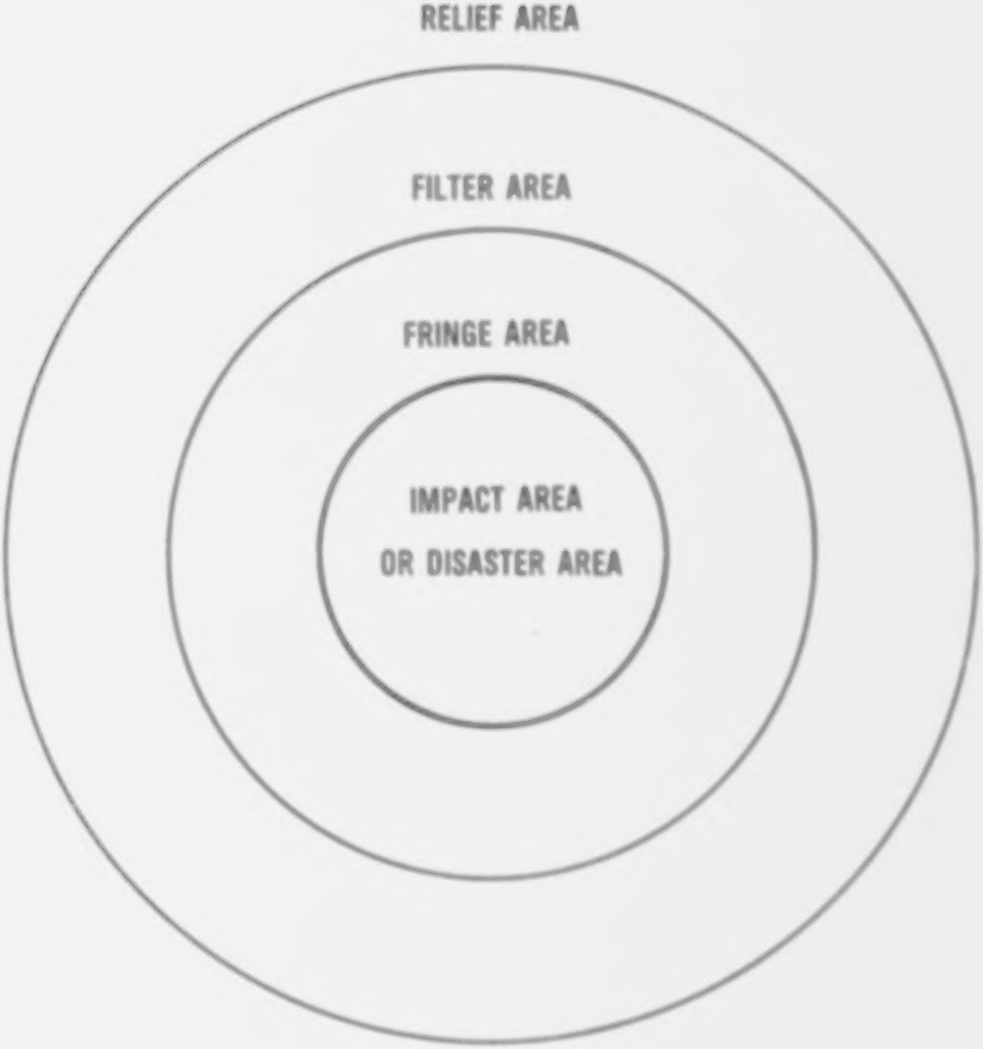


Figure 1-1. Staging areas within a disaster site.

you think of the seven stages of disasters, you see two periods: (1) the period during the disaster itself when communications are disrupted and everyone is pretty much on his or her own. This may last only a short time or be longer, depending on the disaster; and (2) the period during clean up and recovery when communication has been reestablished.

Your preparation, your disaster preparedness training, although very important for both times, may save your family members' lives in the early stage. Cardiopulmonary resuscitation (CPR), water safety instructor (WSI), lifesaving techniques, etc., are examples of training that can help you during the early stages of a disaster.

Disaster Training. Disasters never seem to rear their ugly heads at an appointed time; they are seldom expected or anticipated. Therefore, there are often greater numbers of victims because of the lack of preparation and inadequate communication or information. Preparation for an effective disaster response force is a vital part of the Air Force training program. AFR 160-25, Medical Readiness Planning, and AFR 355-1, Planning and Operations, indicate that training in first aid, hygiene, and sanitation, necessary for survival in disaster situations, is required for all Air Force personnel. Presently, war skills training programs are being developed at Headquarters USAF to standardize training provided to USAF personnel.

Exercises (800):

1. Briefly state the purpose for medical readiness.

2. What are some examples of peacetime disasters?

3. What is important during the warning stage of a disaster?

4. What are some types of training that will prepare you for the early stages of a disaster?

1-2. Environmental Health Service Functions and Responsibilities

The medical mission in any disaster is to reduce the loss of life and limb, to prevent undue suffering, and especially in wartime situations, to conserve military strength by returning the maximum number of personnel to duty as rapidly as possible.

Environmental Health Services, in keeping with its wide ranging public health/preventive medicine role, provides a vital service in any disaster situation. It is up to you not only to prepare yourself, but also to advise and train other medical personnel. You should be concerned with inspecting food affected by floods, fires, tornadoes, or hurricanes, as well as nuclear, biological, or chemical accidents or attack. You should also be able to advise others on many aspects of public health, such as water quality, sewage and waste disposal, and insect and rodent control.

AFR 160-25, *Medical Readiness Planning*, describes the scope of medical operations in disaster control and assigns responsibility for conducting medical activities in disaster control. For you to understand how you directly affect and support the medical mission we will examine the DBMS's and your responsibilities.

801. Describe the functions and responsibilities of Environmental Health Service during disasters.

DBMS. The Director of Base Medical Services is responsible for:

a. Maintaining a medical program in support of base plans for disaster preparedness.

b. Establishing a capability to care for casualties resulting from weapon systems accidents, enemy action, and natural disasters.

c. Training medical personnel and provide technical advice and guidance for training nonmedical personnel in the medical aspects of nuclear, biological, and chemical warfare.

d. Providing detailed medical annexes to basic plans for disaster preparedness.

e. Providing professional and technical advice on personnel protection, decontamination, and exposure resulting from nuclear or chemical agents.

f. Assisting in detecting and identifying biological warfare agents by means of area monitoring, laboratory examination, epidemiological studies, and clinical observation of patients.

g. Maintaining liaison with other Government and civilian agencies in the surrounding community to plan for medical aid in the event of a disaster or attack.

EHS. The Environmental Health Service (EHS) is a vital element of the disaster preparedness program. You are part of the Environmental Health Team as delineated by AFR 160-25, *Medical Readiness Planning*. This team consists of environmental health and bioenvironmental engineering personnel. Your specific responsibilities as part of this team are:

- Detection and identification of NBC agents in the medical treatment facility and base food supplies.
- Medical treatment and field sanitation.
- Disease surveillance.

Let's talk for a minute about your responsibility for medical treatment of injuries resulting from any disaster (wartime or peacetime). At the initial stages of any disaster, patient care is the most important consideration. The major objectives of medical support in any contaminated environment are:

- To manage casualties so that injuries resulting from the contamination are minimized and at the same time any other injuries or illnesses are not aggravated.
- To protect persons handling contaminated casualties or working in contaminated areas.
- To avoid the spread of contamination in ambulances and other evacuation vehicles and in medical treatment facilities and adjoining areas.
- To continue the operation of medical facilities so that other services, unrelated to the medical care and treatment of injuries, are maintained.

The initial emergency medical care must be done rapidly if you are to save the person's life. The most frequent problem will be to determine whether a casualty has a surgical or medical condition which requires priority care over decontamination. For example, severe hemorrhage or a sucking chest wound would require priority over decontamination. The only way we can effectively decontaminate and treat casualties resulting from a disaster is by "triage."

Medical triage is the continuing process of classifying and reclassifying the sick and injured according to the urgency and types of conditions presented. It is a system which makes sure that the greatest good can be given to the greatest number of persons in the shortest time within the means available. This triage process prevents the spread of contamination into areas maintained for normal services and helps each casualty receive rapid treatment. The actual triaging or "sorting" of patients is accomplished by the medical triage officer, or other medical person designated by the commander (senior medical technician, or emergency medical technician (EMT), etc.). The three locations to which a casualty may be directed initially, depending upon the nature the injury, are A (Contaminated Casualties), B (Contaminated Emergencies), and C (Clean Casualties). The "hot line" is the dividing line (or area) between contaminated and uncontaminated areas in a decontamination station (fig. 1-2).

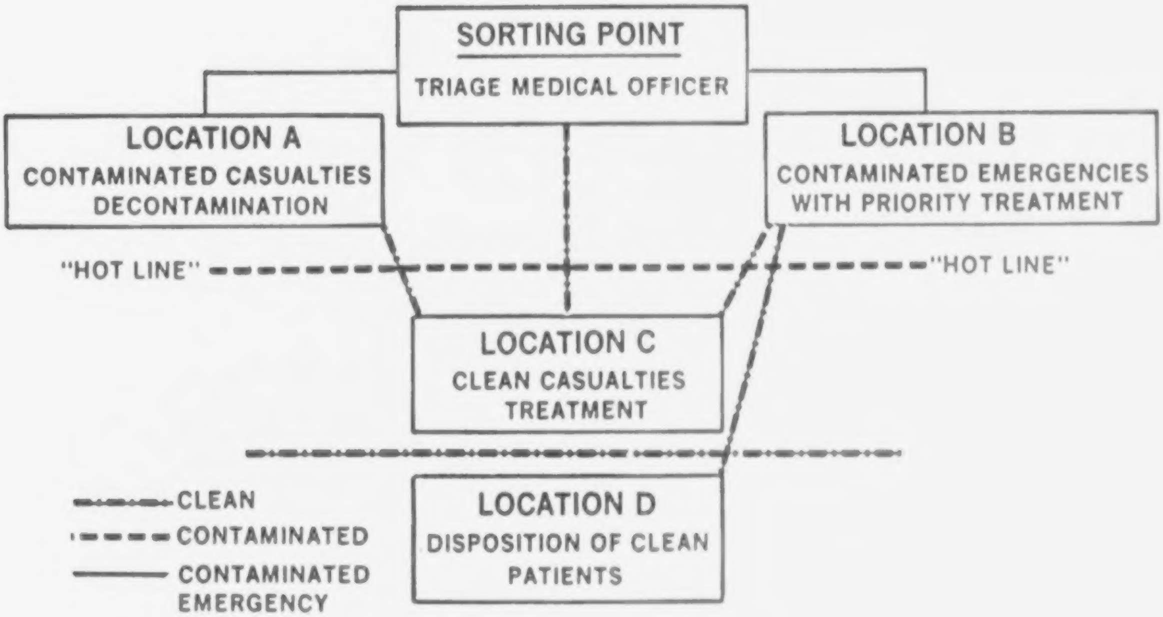

SORTING POINT
TRIAGE MEDICAL OFFICER
LOCATION A
CONTAMINATED CASUALTIES DECONTAMINATION
LOCATION B
CONTAMINATED EMERGENCIES WITH PRIORITY TREATMENT
"HOT LINE"
"HOT LINE"
LOCATION C
CLEAN CASUALTIES TREATMENT
LOCATION D
DISPOSITION OF CLEAN PATIENTS
CLEAN
CONTAMINATED
CONTAMINATED EMERGENCY

Figure 1-2. Patient flow during medical triage operations.

After the patient has been "stabilized" (first aid and/or CPR administered and given antidote if necessary) then the patient must be decontaminated. Regardless of what substances the patient has been exposed to, certain procedures are necessary for effective decontamination. (Refer to figure 1-3 for decontamination procedures.)

Additionally, you (combined with the bioenvironmental engineering personnel) provide assistance in the selection of the base and medical treatment facility shelters by evaluating the medical aspects of shelter selection, (e.g., sanitation, food and water, supply, and environmental controls). Also, you could be asked to provide technical information and guidance to commanders on the medical or environmental consequences of NBC warfare and peacetime disasters. This information and guidance includes procedures for identifying and monitoring hazards, personal protective equipment requirements, status of food, water, sanitation, and communicable disease control. The information you have read in your other CDC volumes (combined with this one) will help you accomplish this job.

Exercises (801):

1. You serve in the disaster preparedness program as part of which team?

2. State other members of this team.

3. What are your specific duties in disaster preparedness?

4. Initially, in any disaster situation what is the most important consideration?

5. What is triage?

6. What other additional support may you be tasked to provide?

1. Patient, on litter, placed on litterstands.
2. Patient's *hood* washed with solution.
3. Patient's *hood* cut away.
4. Patient's outergarments cut from sleeve cuffs to collar.
5. Patient's outergarments cut from collar to waist.
6. Patient's outergarments cut from hip to crotch.
7. Patient's outergarments cut from crotch to pant's cuffs.
8. All cut clothing folded away (down and out) from patient.
9. Scissors, or other cutting device, washed in solution.
10. Steps 4–8 repeated for fatigue uniform.
11. Scissors, or other cutting devices, washed in solution.
12. All remaining undergarments cut away.
13. Scissors, or other cutting devices, washed in solution.
14. Patient washed (head to feet) topside with 4x4s and solutions.
15. Patient lifted (3-man lift minimum) from contaminated clothing.
16. Litter and clothing removed from area.
17. Patient washed (head to feet) bottomside with 4x4s and solution monitored for contamination. If still contaminated; wash again.
18. Clean litter placed on litterstands.
19. Patient placed on clean litter.
20. Patient, on litter, carried to "Hot Line."
21. Litter team and decon team decontaminated (buddy system).

Figure 1-3. NBC patient decontamination procedures.

Natural Disasters

THE PURPOSE OF this chapter is to examine the types of natural disasters and to describe what the USAF Medical Service conceives as a state of readiness to meet each disaster as it might occur. We'll look at the information available regarding natural disasters you may encounter during your time as a military member. We'll also look at some manmade disaster situations which might occur while you are serving as a military medic.

2-1. Types and Effects of Natural Disasters

This section will give you some insight into disasters, their causes, and the ways and means of combating their effects. We will discuss such natural disasters as destructive storms (thunderstorms, cyclones, and tornadoes), floods, earthquakes, volcanoes, fires, and explosions.

802. Describe the types of storms and their effects.

Storms. Destructive storms are potential and continued threats to our installations (table 2-1). Destructive storms may not only cause useless loss of human life but may also cause physical damage at a cost of millions of dollars. In addition to the primary damage caused by the force of the storm itself, extensive damage also may result from flying debris and flooding. Rocks, lumber, steel drums, sheet metal, and loose material of any type may be picked up by the winds and hurled with great velocity. Such flying missiles can cause severe damage to property and serious injury to personnel. Flood water may wash away buildings, drown people and livestock, and deposit mud, debris, and other contaminants everywhere the water reaches.

Thunderstorms. A thunderstorm is a local storm characterized by thunder, lightning, torrential rainfall, and high (squall) winds. Sometimes hail, the most destructive kind of precipitation, develops in intense thunderstorms. Each year in the United States alone, about a 1000 people are killed by lightning, and it is estimated that 2000 people are injured. Property damage from lightning exceeds $100 million annually.

Considerable damage may be produced by squalls with wind gusts sometimes exceeding the minimum velocity of hurricane winds (75 mph). These winds usually are of short duration, and their direction may be radically different from prevailing winds. They tear up roofs, rip off huge limbs from trees, and destroy small grain and garden crops. Probably the worst destroyer of plants, however, is hail, which in a few minutes can shred everything growing in the area.

One of the dangers of thunderstorms is that they develop locally. Frequently there is little time to judge their magnitude and to prepare for them.

In the United States, thunderstorms are most frequent in Florida, the Southeast, the Southern Rockies, and the adjacent Great Plains.

Cyclones. A cyclonic storm is a violent windstorm, usually accompanied by much rain, thunder, and lightning. These storms normally travel over the surface of the earth at speeds from 10 to 30 mph.

Cyclones are especially prevalent in the tropics. Nearly 70 percent of them occur in the West Indies and the China Sea from August to October. Hurricanes are one type of cyclonic storm. They occur seasonally in certain well-defined areas, called hurricane belts. Hurricanes that originate in the Indian Ocean and the Asian Pacific are called typhoons.

Remember that hurricanes or typhoons do not always follow the same paths, but are erratic and unpredictable in their movements. Hurricanes originating in the Atlantic usually move in a curved line (fig. 2-1), although movement in a comparatively straight line is not unusual.

It is said that the winds of a single hurricane expend enough energy in 1 day to operate all the world's powerplants for several years. Obviously, great damage may result when such tremendous energy is released against a coastal city. Of all the hurricanes that have struck American cities, the worst was in 1900 in Galveston, Texas, when more than 6,000 people perished.

Tornadoes. Tornadoes are the most violent and most destructive of all windstorms. In contrast to hurricanes (or typhoons), tornadoes occur mainly over land areas. In some instances, tornadolike storms develop over water, but these disturbances are called waterspouts. Tornadoes appear to be mainly an American phenomenon, rarely occuring in other countries. Tornadoes frequently form in the Central Mississippi Valley, particularly in spring and early summer. They are caused by cold air from Canada meeting warm air from the Gulf of Mexico. Whether or not a tornado develops depends on the shape of the cold front at the time. After forming, tornadoes usually travel about 25 to 40 miles an hour and normally move from the southwest to the northeast. Although tornadoes can travel as far as 300 miles, the average path of destruction is 4 to 5 miles long and 100 to 200 feet wide.

An approaching tornado characterized by heavy rain, thunder, and an ominous dark mass of clouds from which hangs the funnel-shaped tornado. As the storm moves along, the end of this funnel or vortex may touch the

TABLE 2-1
DISASTER RELATED HEALTH PROBLEMS

Type	*Mortality*	*Morbidity*	*Environmental*
Tornado	Mobile home Vehicular	Multiple fractures Abrasions	Damaged health facilities Insulative debris contamination
Flood/Hurricane	Drowning	Depression Hypertension	Water Contamination Snake Infestation Housing destruction
Heatwave	Heatstroke Other CV	Cardiovascular problems Dehydration	Power shortages Fatigue in rescuers
Volcano	Asphyxia Burns	Respiratory problems Eye irritation	Respirable volcanic ash Land and water contamination
Snowstorm	MI CO Asphyxia	CV problems Depression	Transportation disruption Isolation of health facilities

*Note: CV — cardiovascular problems.
MI — myocardioinfarction.
CO — carbon monoxide poisonings.

earth's surface. Some storms whirl along the ground for a distance, rise, and then touch again a mile or so farther on. In addition to the thunder, there may be a roar when the vortex touches the earth's surface. The winds of a tornado blow spirally upward and counterclockwise around the axis of the tornado cloud. The speeds of tornado winds have never been measured directly. Based on effects produced, however, the velocity of these winds has been estimated to be as high as 500 mph. The updraft within the funnel cloud may have a velocity of 85 to 200 mph. This updraft frequently sucks up large objects and deposits them considerable distances away. It is from this twisting spiral updraft that tornadoes have been dubbed "twisters."

Although tornado conditions can be predicted with great accuracy and predictions are broadcast, they are for specified areas and times. Because tornado paths and times cannot be pinpointed, however, some people may ignore warnings and thereby a few lives and some property are needlessly lost.

The center of a tornado, called the eye, is one of the most destructive parts of the storm. The eye is an area of low barometric pressure. This low pressure causes buildings in the path of the eye to lift upward and to explode. Because the path or eye of the tornado is very narrow, buildings on one side of a street may be demolished while those on the other side escape unharmed.

Emergency response. In anticipation of hazardous or destructive winds, it is customary for precautionary measures to be implemented. As established by the National Oceanic and Atmospheric Administration, (NOAA), conditions of readiness are as follows:

a. Condition IV: Trend indicates a possible threat of destructive winds (gale, storm, hurricane, or typhoon) of force indicated, within 72 hours.

b. Condition III: Destructive winds (gale, storm, hurricane, or typhoon) or force indicated are possible within 48 hours. Take preliminary precautions.

c. Condition II: Destructive winds (thunderstorm, tornado, gale, storm, hurricane, or typhoon) of force indicated are anticipated within 24 hours or, in the case of thunderstorms and tornadoes, are reported or expected in the general area. Take precautions that will permit establishment of an appropriate state of readiness on short notice.

d. Condition I: Destructive winds (thunderstorms, tornado, gale, storm, hurricane, or typhoon) of force indicated are imminent. Take appropriate precautions to minimize damage.

There are several things you can do to respond to each of the conditions of readiness. Many measures providing protection during destructive storms must be planned in advance. Some of these long-range, protective measures include:

a. The use of trees as natural windbreaks.

b. Proper design and construction so that walls of buildings are well braced and tied to the foundation, the roof secured firmly to the walls.

c. Avoidance of building sites close to a waterfront.

Precautionary measures against natural disasters caused by destructive winds include:

a. Maintaining structures in conditions comparable to design strength.

b. Guarding against erosion of areas subject to being washed away by storms.

c. Sandbagging operations.

d. Covering window panes.

e. Removing vehicles and equipment from outside parking areas subject to being washed away or to damage

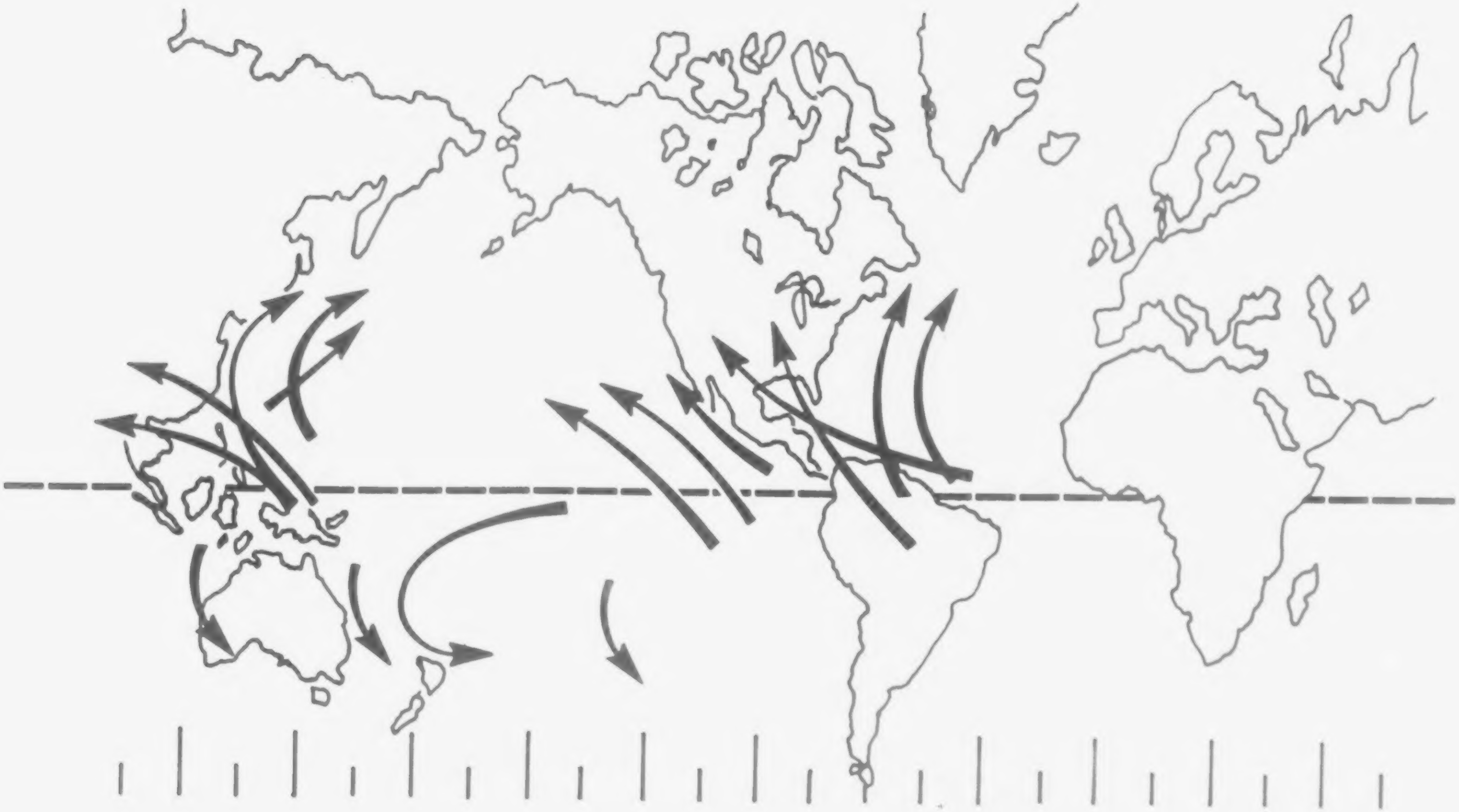


Figure 2-1. Paths taken by hurricanes.

from falling trees.

f. Providing adequate water supplies for fire fighting.

Exercises (802):

1. Why are thunderstorms so dangerous?

2. What are some characteristics of a cyclonic storm?

3. What is the most violent and destructive of all windstorms?

4. Describe the eye of a tornado.

5. List the conditions of medical readiness in order based on the degrees of destructiveness (minimum damage to worst).

6. Cite some precautionary measures to be taken for protection against natural disasters.

803. State the effects of floods, earthquakes, tidal waves, volcanoes, and fires.

Floods. A flood is defined as a body of water rising, swelling, and overflowing land areas. Most river floods result from natural causes, such as excessive rainfall, melting snow, or ice jams. Sometimes floods are caused by abnormally high ocean tides, tidal waves, or storms at sea. Occasionally floods are caused by overtopping or failure of dams and dikes.

In general, floods are classed as either regular or flash floods. Regular floods usually can be predicted. For example, certain rivers are known to flood each year, and the height to which the water will rise, as well as the time of the crest, can be predicted with considerable accuracy. In these examples, usually sufficient warning is given to permit personnel evacuation and to institute last-minute flood preparations. Despite such warnings, however, many people lose their lives in seasonal floods. Flash floods are created by torrential rainfall on barren, wet, or frozen ground. Rapid runoff causes raging rivers to be present in river beds that are normally low or dry. Frequently, many people are caught unprepared and lose their lives either by drowning or exposure to the elements.

Flood damage results from both the washing away of the soil as well as from the mere velocity of the floodwaters. Probably the worst effect of the soil movement is the resulting mud deposits. Slimy, penetrating mud is difficult and costly to remove. The velocity of floodwaters undermines or washes away bridges, structures and valuable farmland, and destroys roads, buildings, vehicles, and other equipment.

Fire is one of the hazards accompanying floodwaters. Occasionally rising water upsets oil or gasoline tanks and spreads their contents over wide areas. If these combustibles are set afire, the fire spreads rapidly. Floating debris and other combustible material in the flooded area usually provide ample fuel.

Earthquakes. Few great earthquakes occur alone; usually, they are preceded by foreshocks and followed by aftershocks. Foreshocks are minor quakes with the same center (focal point or epicenter) as the major shock. For months or even years after a big quake, there may be hundreds of aftershocks strong enough to be felt. Because earthquakes are difficult to predict, they may strike without warning, and there is frequently no time even for last-minute preparations.

Earthquakes are more numerous than most people realize; thousands of tremors are recorded each year. Of this number some 600 to 700 are classed as important and 50 to 100 as disastrous, depending on the population density of the area affected.

The horizontal shifting produced by earthquakes causes rows of crops, fences, and roads to be displaced many feet, shifts houses on their foundations, and breaks apart unit masonry buildings. In every important earthquake, it has been demonstrated that if buildings survive there will be correspondingly slight loss in human life—a challenge for both the engineer and the architect.

Tidal Waves. Some oceanic earthquakes generate large waves called tidal waves. A tidal wave is a great sea wave that suddenly floods the land. Although tidal waves may occur almost anywhere along a seacoast, they seem to occur most frequently in certain areas, such as the western coast of Central and South America, the Hawaiian Islands, Japan, and China. Most tidal waves are caused by earthquakes beneath the ocean floor. Occasionally, winds accompanying a hurricane or a typhoon will whip and pile the sea into a tidal wave.

A characteristic feature of a forthcoming tidal wave is a general withdrawal of the sea, somewhat like an exceptionally low tide. The time of the water's return varies from several minutes to approximately 1 hour. The returning tidal wave plunges toward shore at such phenomenal speed that few, if any, last-minute preparations can be made.

Seawalls of earth and masonry can be utilized to provide a measure of protection from small tidal waves. If large waves are expected (exceeding 100 feet in height, for example), then the only positive protection is to avoid waterfront construction as much as possible and build on higher ground.

Volcanoes. A volcano is a mountain, more or less conical in form, which has a depression or crater at the top. Actually, the crater is a vent in the earth's crust through which molten rock and steam issue. A volcano is called active while it is in eruption; dormant during a cessation of activity, and extinct when eruptions cease completely.

The activity of a volcano is in cycles. An eruption is followed by a quiet period during which pressure is built up for another burst of violence. The end of a cycle is marked with an eruption. The character of an eruption varies from a quiet outpouring of molten lava, as in the Hawaiian Islands, to violent explosions accompanied by showers of ash and cinders, as in Mount St. Helens. An eruptions usually leaves a deep crater that gradually is filled again by liquid lava entering at the bottom. The temperature of the lava increases until pent-up internal forces cause another blowoff or eruption. Molten lava pours from the crater and rolls down the mountainside, frequently engulfing whole towns or villages in its path. Sometimes sulfurous fumes, earth tremors, and showers of volcanic ash occur. When the crater is drained, the cycle of activity begins again.

Although volcanoes are sites of potential natural disasters, they usually give some warning before they erupt. As our knowledge of volcanoes increases, it becomes easier to avert catastrophes such as overtook ancient Pompeii and more recently Mount St. Helens. (Note that the volcanic eruption of Mt. St. Helens had the equivalent of 100-megaton (Mt) surface burst.)

Fires. In peace or war, fire is one of the greatest destroyers of mankind and property. An average of 33 persons perish in the 1000 fires of all kinds that break out daily in this country. This estimate means that about 12,000 Americans die each year as a result of fires. Annual fire losses in America exceed 1 billion dollars.

The possibility of fire is one of the first hazards that needs to be considered in any disaster. Fires that follow floods, earthquakes, explosions, and other disasters usually cause more devastation than the initial or primary catastrophe itself. For example, it was the fire after the San Francisco earthquake in 1906 that caused most of the property damage.

Fire Storms. A fire storm is an atmospheric disturbance caused by a large fire, such as after extensive bombing of a city, wherein a central column of rising heated air causes a strong wind, called a fire wind. The fire wind rushing in from all sides feeds the fire, causing it to burn more intensely. If there is a layer of cold air above the fire, the rising column of hot burning gases may cause moisture to condense so that rain falls. Often the rain is black, because the moisture condenses on soot particles.

A fire wind may reach gale proportions. These winds can uproot trees 3 feet in diameter, cause building walls to collapse, break down doors, spew burning branches and other debris into the air, and turn over automobiles. Fire winds also prevent firemen from coming within range with their hose streams.

Temperatures in fire storms often reach the ignition point of all combustibles; therefore complete burnout follows. The fire storm that occured in Hamburg, Germany, as a result of a strategic allied bombing mission during WW II burned for nearly 2 days before the area had cooled enough to allow firefighting personnel to start to try to control the fire. No traces of unburned combustible building material or plant life could be found except brick walls and a few large charred trees.

Conflagration. A conflagration is similar to a fire storm in that it is a large fire with a central column of rising heated air and burned gases, but a conflagration spreads. Normally, conditions are such that there is a strong wind that slants the central column of heated air and gases. The higher the wind velocity, the more the column leans and the closer the heated air and burning gases approach combustible materials on the ground. A chief characteristic of a conflagration, therefore, is the presence of a fire front (an extended wall of moving fire) preceded by a mass of burning vapors. This advancing wall of fire preheats the surrounding area and permits the conflagration to spread until no more combustible material is found. Sometimes buildings are ignited by the intense heat of this advancing heat wave before the flames reach them directly. A conflagration does not move or spread evenly; it jumps ahead of the firewall to engulf new combustible material. Burnout in a conflagration is not as complete as in a fire storm because of the irregular heat currents and firebreaks, i.e., natural and manmade open spaces. A conflagration can turn into a fire storm, however, if the wind dies down and the other atmospheric conditions are favorable.

The four major classifications of peacetime conflagrations include:

(1) Conflagrations that develop from fires that begin in hazardous industrial areas and congested or fire-breeding sections of a city and spread before firefighters can reach the scene. Such fires usually spread in the direction of the prevailing wind. Spreading by means of radiated heat, they cross streets and other open spaces to burn other buildings. Their spread is enhanced largely by a lack of adherence to construction firesafety codes and a lack of sufficient water application when the fires are small.

(2) Conflagrations that arise from fires occuring in closely built residential areas. Communities of combustible construction are vulnerable, especially those with wooden shingle roofs. This type of conflagration develops mainly because of weak fire protection forces or inadequate water supplies.

(3) Conflagrations that develop from raging forest or brush fires that either engulf a community or strike along an extensive front where water supplies and firefighters are either inadequate or overtaxed.

(4) Conflagrations that grow from explosions that cause fires over a widespread area.

Exercises (803):

1. What are some effects of floods?

2. Why is disaster preparedness for response to earthquakes difficult?

3. Describe the events before the tidal wave hits land.

4. How do most volcanic eruptions occur?

5. Describe a "fire storm."

6. What are the four major classifications of peacetime conflagrations?

2-2. Types and Effects of Manmade Disasters

In the last section we talked about the types and effects of natural disasters. This section addresses man-made disasters or accidents in peace-time; i.e., explosions, chemical spills, and peacetime nuclear weapons accidents. Additionally, fires may also be caused by carelessness. Most of the effects of fires were discussed earlier in this chapter.

804. Identify the hazards of explosions and industrial accidents.

Explosions. Explosions are characterized by their shattering effect as well as by their speeds of detonation. Because low explosives explode much more slowly than high explosives, they push rather than shatter their immediate surrounding. An example of a low explosive is gunpowder which is used as a propellant in a firearm. It explodes slowly, pushing the projectile forward without shattering or damaging the gun barrel. Gasoline is another example of a low explosive. Even dust could be a low explosive if the particles are fine enough and made of a combustible material. Coal and wood dust have caused explosions in the past. The explosive problem with wood dust is one of the reasons for ventilation systems in carpenter shops; i.e., remove the flammable materials out of the building. Additionally these systems help to control the concentration of airborne dust that may be inhaled by the workers.

Disasters occur with both high and low explosives; however, greater destruction usually results from high explosives. One of the most serious peacetime explosions on record occurred in 1917 at Halifax, Nova Scotia, when 2600 tons of high explosive detonated, killing 1800 people and injuring another 8000. The explosion broke glass as far away as 60 miles. Another tremendous peacetime explosion took place at Oppau, Germany, in 1921. Here an open pile of 9,000,000 lbs. of ammonium nitrate fertilizer detonated, killing 1100 people and injuring 1500 more. The serious damage caused by this explosion extended for 4 miles.

Causes. The principal causes of the detonation of explosive materials, in addition to intentional detonations, are carelessness, high temperature, sudden shock, and a combination of temperature and shock (sympathetic detonation).

Effects. An explosion usually produces these characteristic effects: (1) an airblast, (2) a shock wave, and (3) flying missiles. Moreover, fire and earth shocks sometimes accompany an explosion, but they are not considered principal effects.

Airblast. Upon detonation, a high explosive produces a huge volume of hot gases under pressure. Temperature of these gases is several thousand degrees. The gases' velocities are high, perhaps as much as 20,000 miles an hour. As these hot, expanding gases meet the surrounding air, their momentum pushes the air outward to form the air blast. This blast sweeps aside everything in its path. Because of the great air resistance to be overcome, the blast quickly loses its pressure and momentum; consequently it travels only a short distance. It is estimated that the spherical airblast for a 500-pound bomb travels about 25 feet.

Shock waves. Shock waves form when the hot, expanding gas in an explosion comes into contact with water or earth. A shock wave is like a sound wave in that it travels through air, soil, or water in a similar manner. Shock waves from powerful explosions can break windows miles away.

A shock wave consists of two phases. Initially, a short overpressure (positive pressure) phase develops, which is followed by a somewhat longer negative pressure or suction phase (fig. 2-2). Overpressure is the pressure exceeding the normal atmospheric or ambient pressure.

Flying missiles. About the same time the airblast and shock wave are released, shell fragments and objects picked up by the air blast begin to move from the site of the explosion under the force provided by the airblast and shock wave. Because of their mass, these missiles are slow to gain momentum and so travel behind the shockwave. As their velocities increase, and as the airblast and shock wave begin to lose velocity and force, these missiles overtake both the airblast and the shock wave. Often, flying missiles arrive at their destination well ahead of either the airblast or the shock wave. Flying missiles can travel great distances at tremendous velocities, and, depending on their size and weight, they often travel a mile or so from an explosion. Frequently, considerable damage is caused by ricocheting missiles.

Industrial Chemical Accidents. Although you probably may not be responding to an industrial accident site; i.e., wreck of a train car carrying chemical agents, or a spill in an industrial shop, you will, however, be decontaminating the victims and advising the physician on how to treat any injuries or illnesses resulting from the accident. For example, you might be called upon for advice if personnel from the Base Entomology Section are overcome by the pesticide parathion while spraying in the Base Exchange Floral Shop. They are transported to the emergency room and the physician asks you if there are any special tests he or she should run on these individuals because of the overexposure. After consulting your references you advise him or her to ensure that blood cholinesterase levels are checked. It is very important that you know where to go for the information concerning these chemicals. *Occupational Health Guidelines for Chemical Hazards* (NIOSH 81-123); *Occupational Diseases: A Guide to Their Recognition* (NIOSH 77-181); *Pocket Guide to the Chemical Hazards* (NIOSH 78-210); and *Hazardous Materials, Emergency Response Guidebook* (Department of Transportation DOT P 5800.2) are excellent sources of information for reference.

Industrial Radiological Accidents. In addition to the hazards associated with chemical compounds in industrial accidents, it is important that you are prepared to deal with accidents involving radioactive materials. Some examples are as follows:

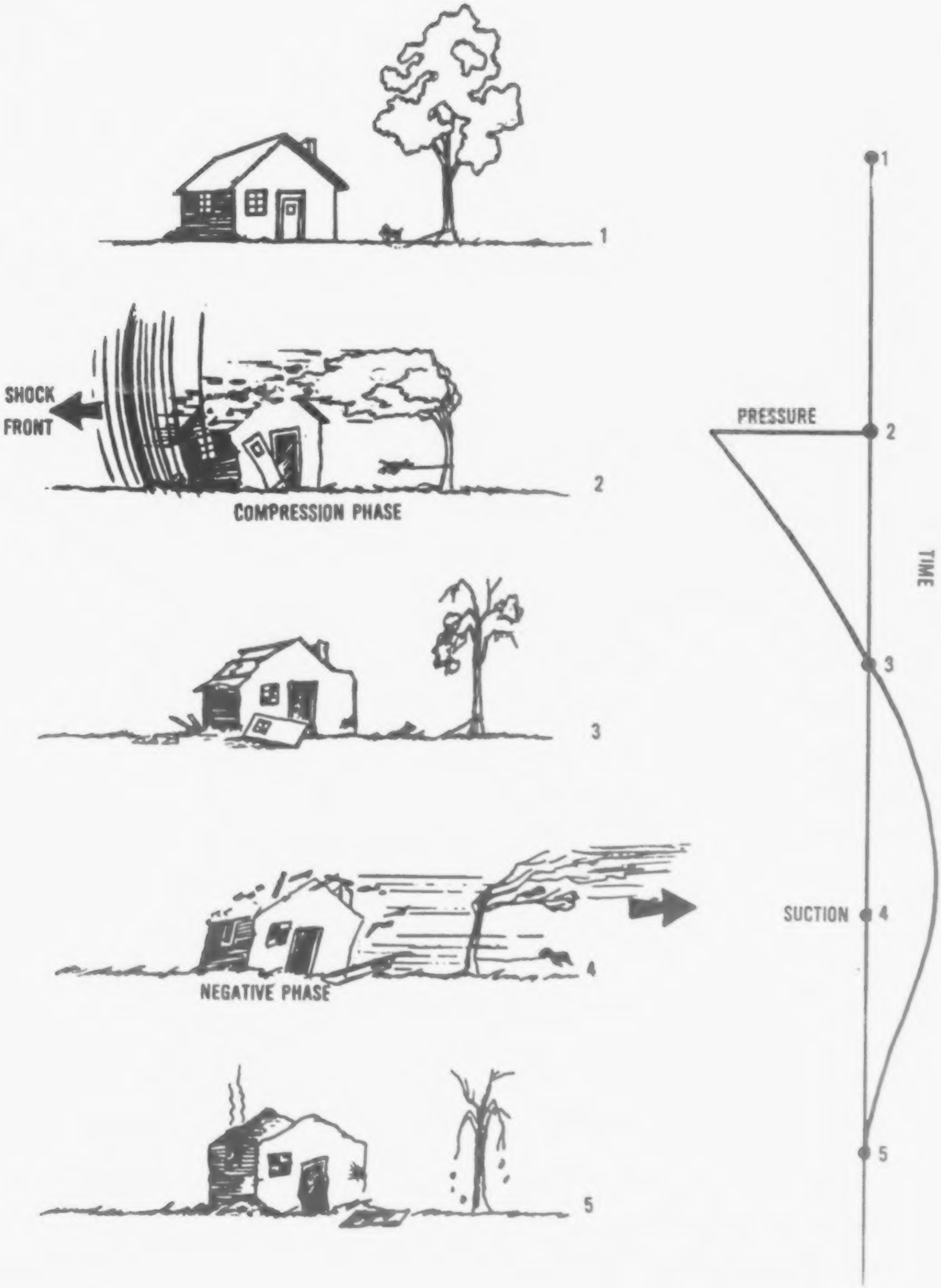


Figure 2-2. Variation of blast effects associated with positive and negative phase pressures with time.

a. Radioactive sealed sources used in base-level equipment calibration.

b. Spill of liquid radioactive material or an inadvertant release of radioactive gas during nuclear medicine operations.

The type of medical follow-up required for those exposed to ionizing radiation would depend upon the specific type of radioactive isotope they were exposed to and whether it presents an internal or external hazard. Generally, for *non-ionizing* exposures an in-depth examination of both the eyes and the skin should be made. Of course, there are exceptions to the type of medical followup that is necessary. If you have these types of industrial processes at your base, being prepared (i.e., medically ready) for a potential disaster in these areas may save someone's life.

As you are well aware, there are radioactive materials that are also used in uniquely military systems. Recently released data indicates that worldwide nuclear weapons may exceed 70,000 in number. One idea you need to keep in mind at all times is the fact that these weapons are stored, shipped, and maintained virtually all over the globe and that the possibility of a peacetime nuclear weapons accident by far outnumbers the possibility of global nuclear warfare. Nuclear warfare will be discussed at length in a later chapter.

Exercises (804):

1. What are the three effects usually produced by an explosion?

2. State the two phases of a shock wave.

3. Where can you find information on the effects of toxic chemicals?

805. Cite the types and hazards of peacetime nuclear weapons accidents.

Peacetime Nuclear Weapons Accidents. Possession of nuclear weapons bestows upon the possessor certain responsibilities for safeguarding weapons handlers, weapons loaders, aircrews, and other auxiliary personnel. In fact, any military or civilian population must be protected from the potential health hazards developed by fabrication, storage, transportation, or physical possession of such devices. This section will explain the medical hazards and major medical actions to be taken.

Types. The weapons we speak of are designed to be safe, but they are handled by humans. Historically, the public reaction to weapons accidents has been one of panic. First, let's look at the types of nuclear weapons accidents. Secondly, we need to discuss the phases of a nuclear weapon accident.

BROKEN ARROW (nuclear accident). BROKEN ARROW is the term applied to an unexpected peacetime or noncombat nuclear weapon accident. This includes the loss or serious damage to a nuclear weapon or Aircraft Electronic Communication (AEC) component, whether by intentional jettisoning or inadvertent release or by nuclear or nonnuclear detonation of the weapon, causing radioactive contamination or other public hazards.

BENT SPEAR (nuclear incident). The term BENT SPEAR means that the damage, malfunction, or failure of a nuclear weapon has occurred which is sufficient to render it unsafe or nonoperational. The extent of the damage requires major rework or complete replacement to assure operational reliability and nuclear safety.

DULL SWORD (nuclear safety deficiency). A DULL SWORD is any mishap contributing to a nuclear accident or incident which could cause damage to a weapon which USAF field units are authorized to correct (bent fins, dents in ballistic case, etc.). Any deliberate, unauthorized act which degrades weapon reliability or safety, such as damage or malfunction of the suspension and release systems; failure to adhere to established safety procedures; and malfunction or failure of handling, loading, storage, maintenance, transportation, or test equipment involving a nuclear weapon also would be referred to as a nuclear safety deficiency or a DULL SWORD.

FADED GIANT (nuclear reactor accident). FADED GIANT is the term used to describe an uncontrolled reactor accident resulting in damage to the reactor core or release of fission products from the reactor core to the atmosphere or surrounding environment.

FADED GIANT GIANT (radiological accident). This term describes loss of control of radioactive material which presents a hazard to life, health, or property or which may result in any member of the general population exceeding exposure limits for ionizing radiation. The 3-Mile Island incident would have been called a FADED GIANT GIANT had the accident occurred on an Air Force base and got much worse.

Hazards. Let us now look at some of the hazards which could result from such an accident. These hazards are of concern to you as an Environmental Health Specialist because of your responsibilities to patient care, food supplies, and protection of personnel and the general public.

Explosive hazards. Contrary to widespread public belief, radiation is not the prime hazard associated with a nuclear weapon accident. The greatest hazard is a high-explosive detonation with accompanying blast hazard as far away as 2000 feet from the site. Pieces of unexploded high explosive (HE), detonators, and nuclear material may be blown out and scattered throughout the accident scene, creating an additional hazard. After fires have been controlled, or after a one-point detonation has occurred, the danger of explosive hazards still exist. Scattered detonators, melted HE, or HE fragments are pressure sensitive and continue to be a source of danger to rescuers and spectators.

Radiation hazards. Although high explosives create the major hazards under certain conditions radioactive elements may also create a potential public health hazard. Among the radioactive elements most often associated with nuclear weapons accidents (BROKEN ARROW) are tritium, uranium, and plutonium. If a nuclear detonation did occur, strontium-90 and iodine-131 (fission products) should be considered as potential hazards. However, it must be noted that the mathematical possibility of a nuclear detonation occuring as a result of a BROKEN ARROW is extremely low.

a. Tritium. Tritium is a gas that diffuses very rapidly and has the capacity to replace ordinary hydrogen in some materials, causing the material to become radioactive. In its basic form, tritium does not present a severe biological hazard. It emits a weak beta particle which is not able to penetrate the intact skin and is not readily absorbed by skin or lungs. However, it can combine with oxygen to form tritiated water vapors. In this form it is readily absorbed through the skin, and almost 100 percent of the vapor taken into the lungs will be absorbed by the body.

Although tritium has a short biological half-life (the time it takes the body to rid itself of one-half the amount), it is highly active. This means that even small quantities within the body emit hazardous amounts of radiation. Since the tritium enters the body as water, it permeates the cell's membrane and causes severe damage to the cell.

b. Uranium. Uranium occurs in various natural formations such as pitchblend, which is relatively unknown to most people except geologists and physicists. The greatest hazard of uranium to humans is thorugh ingestion. Therefore, food and water supplies that may have been exposed must be inspected and decontaminated or quarantined as necessary. Significant amounts of uranium contamination may result from a BROKEN ARROW. However, none of these are as hazardous as plutonium, which is the most hazardous radioactive material associated with a BROKEN ARROW.

c. Plutonium. Plutonium is the most hazardous radioactive material associated with a BROKEN ARROW. It fissions readily and emits alpha, beta, and gamma radiation. There is alpha, beta, and gamma radiation wherever plutonium is found in any quantity. However, if plutonium particles are thinly dispersed over a larger area as a result of HE detonation, alpha particles are the main hazard of concern.

Plutonium is a bone seeker with a biological half-life of 200 years. This means that once inside the body, it is transported to and deposited in the bone cells, and at the normal rate of function, it would take the body's physiological processes 200 years to eliminate one-half of the radioactivity. When associated with fire or explosion, it is readily burned, pulverized, and carried by smoke and hot air currents to contaminate a large area. Accidental human exposure may occur during firefighting and rescue operations, radiological monitoring, and environmental sampling procedures. The primary hazard from plutonium is usually due to resuspension in the air of the minute radioactive particles. These particles (which are alpha emitters) may then be inhaled into the body.

Nonradiation hazards. Three elements, while not radioactive, are used for their nuclear properties and may present toxic hazards if involved in an accident or fire. These are beryllium, lead, and lithium.

a. Beryllium. Beryllium is a metal which resembles magnesium. It is extremely toxic. Inhalation is the most significant mode of entry into the body. Beryllium oxidizes (burns) easily, and any fire or explosion involving beryllium is almost certain to release hazardous fumes and smoke. Absorption through the skin is also a significant mode of entry for beryllium. Cuts, scratches, and abrasions contaminated with beryllium become ulcerated and heal very slowly. Since it is not radioactive, detection of beryllium in the field is impractical. In the vicinity of a fire involving this material, protective clothing and some form of respiratory protection is essential.

b. Lead. Lead is widely used in shielding. Pure lead and most of its compounds are toxic. The metal may enter the body by inhalation of vapors, mists, or fumes or by ingestion or skin absorption. Respiratory protection and anticontamination clothing provide adequate protection against lead absorption hazards caused by lead in a fire or explosion.

c. Lithium. Another nonradioactive hazard involved in a nuclear weapon accident is the element lithium. Combined with hydrogen and oxygen, it forms an extremely caustic compound. In acute exposures it can cause intense irritations and ulceration of the skin and respiratory tract.

Exercises (805):

1. What is a BROKEN ARROW?

2. What is a BENT SPEAR?

3. What is the primary hazard associated with a nuclear weapon accident?

4. Why is plutonium such a hazardous by-product of a nuclear weapon accident?

5. List some other radioactive hazards associated with a nuclear weapon detonation.

6. What are three nonradiation hazards associated with nuclear weapons accidents, and what is the mode of entry into the body for each of them?

806. Cite personal protective measures and decontamination procedures.

Monitoring. Since alpha particles emitted from plutonium fragments create the greatest hazard in a Broken Arrow, the monitoring and control procedures for this hazard satisfactorily control other toxic compounds. This monitoring procedure will be described in detail in the chapter titled "Nuclear Warfare." Alpha contamination is divided into two categories: the first is "surface contamination" (a concern with food contamination); the second is "airborne contamination" (a food and personnel hazard). Remember, the primary hazard from plutonium is usually resuspension of the radioactive particles which could contaminate both personnel and food supplies.

Personal Protection. Personnel performing operations in contaminated areas should wear protective clothing and respiratory protection. Protective clothing should include coveralls, shoe covers, gloves, and head cover. Clothing should be buttoned and taped closed at all openings. No unprotected skin should be visible. Respiratory protection may be afforded by a respirator of at least 95-percent efficiency such as the M-17 series protective masks. Upon leaving the area, everyone should be monitored for contamination. Contaminated clothing should be placed in covered containers and transported to a decontamination area or facility. Upon removal of contaminated clothing and equipment, everyone should again be monitored for contamination. If possible, necessary decontamination should be done in the field.

Personnel Decontamination. Radiation contamination cannot be destroyed; it must be allowed to decay naturally. Decontamination procedures can localize or minimize radiation exposure. Decontamination should be performed according to priority or importance of area or item contaminated. The most important facet of decontamination is the protection of people from exposure to radiation. Personnel decontamination is essential to prevent irradiation and internal deposit of radioactive particles. At the outset, the goal of personnel decontamination is complete removal of contaminants to achieve zero levels of radiation. If, after repeated attempts, these levels are not attainable, the maximum allowable skin-contamination levels are 660 counts per minute (cpm) for alpha using the PAC-1S and 1 mr/hr (miliroentgen per hour) for beta/gamma contamination using an AN/PDR-27 (these instruments will be discussed in the chapter on nuclear warfare). If achieving these radioactivity levels is not possible, you should isolate the patient and attempt further decontamination as recommended by health physicist (e.g., a sauna to cause the body to sweat and release the particles, or other therapy).

The first effort in personnel decontamination is proper removal of contaminated protective clothing. Proper sequence in removal minimizes contamination of skin surfaces and ingestion or inhalation of contaminants. Contaminated clothing should be removed in the sequence shown in figure 2-3. Notice that gloves are left on to protect the hands while other items of contaminated clothing are removed. Begin by removing headcover, outer garments, and boots. Loosen both gloves and shake them into the container. Remove socks and underclothing. Shower, using plenty of soap and warm water. Remove the protective mask last, after you are in the shower. After a complete shower, monitor for spot contamination. Spot contamination may be removed by using soap and water.

The first step in spot contamination is to locate, mark, and isolate the contamination to prevent spreading it to other areas. Try to remove the contamination with pieces of masking tape (like removing lint from clothing with tape). Monitor between each of your decontamination attempts to determine its effectiveness. Wash with mild soap and warm water. Rinse, dry, and monitor. Resort to the acids, alkalies, and organic solvents only after all other methods fail. If these are necessary, hand cream should be applied to the area to restore oils to the skin.

If contaminants have infiltrated the pores and cannot be removed, sweating may be induced to aid in decontamination. For instance, rubber surgical gloves, worn for about 30 minutes, cause the hands to sweat and contaminants may be washed out. The final step is a complete body shower, with special attention on the hair, hands, and fingernails.

Equipment Decontamination. Decontamination is generally performed through the removal of contaminants to a less critical location, dilution, or shielding (covering) the contaminant and allowing natural decay. Removal techniques vary in effectiveness according to the surface being contaminated. Perhaps the most difficult of all decontamination problems is that of equipment. Some equipment contains delicate mechanisms and electrical components which prevent dipping into solutions. Many have depressions and folds which cannot be reached easily for cleaning.

Regardless of the difficulty, there are many methods available for decontaminating equipment. The choice depends upon the effectiveness and availability of decontaminating agents and upon the value of the equipment. In some instances, it may be preferable to dispose of the equipment as contaminated waste. A summary of decontamination methods is shown in table 2-2. This table not only gives the decontaminating agent and the surfaces for which each is suitable, but it also explains the action of the agent, the technique for using the various methods, and the advantages and disadvantages of each.

Exercises (806):

1. How does plutonium present a hazard in a BROKEN ARROW?

2. State the required personal protective equipment for people performing operations in contaminated areas.

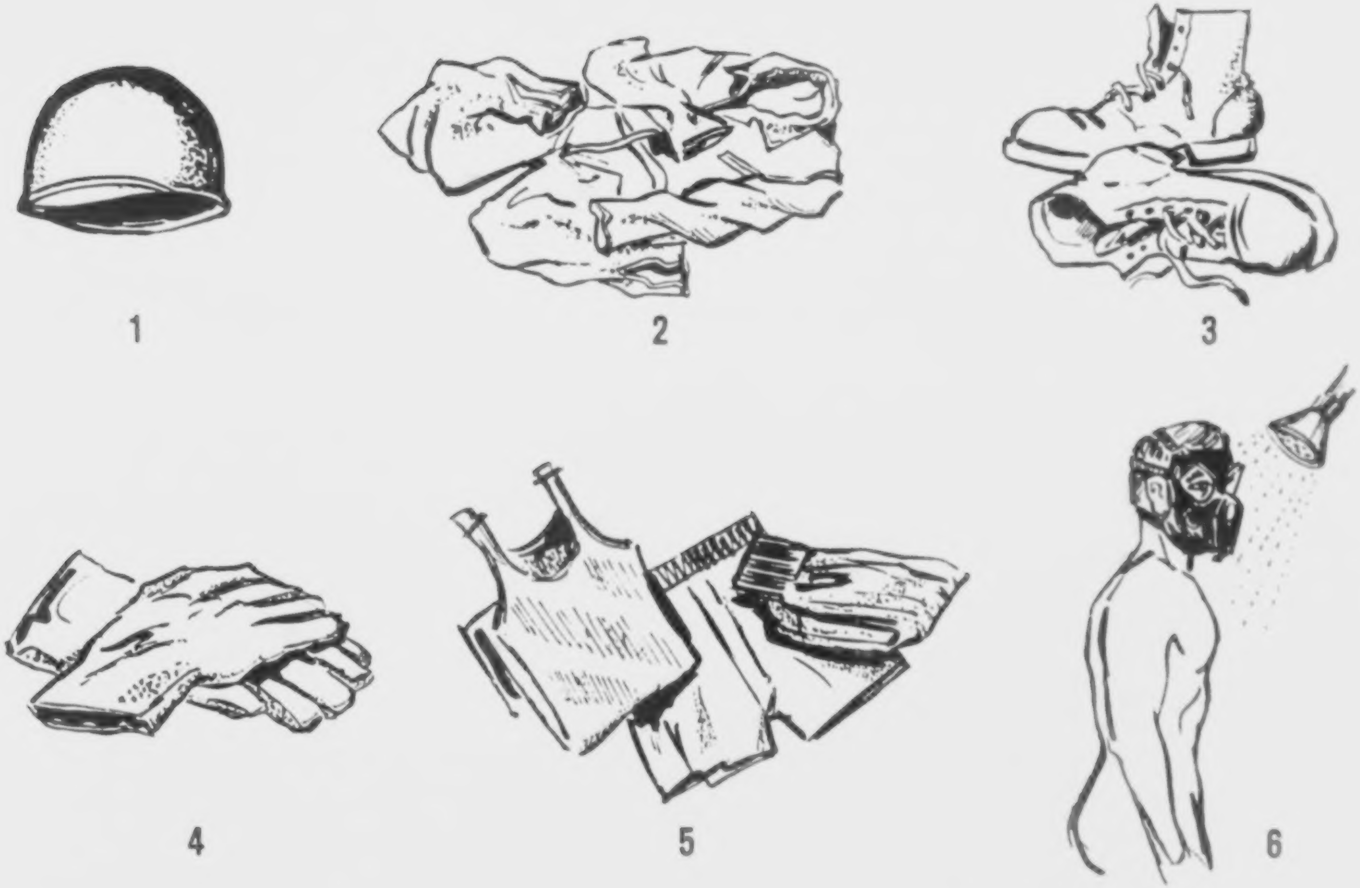


Figure 2-3. Sequence for removal of contaminated protective clothing.

TABLE 2-2
SUMMARY OF SURFACE DECONTAMINATION

Method	Surfaces	Action	Technique	Advantages	Disadvantages
Abrasion	Nonporous surfaces.	surface removal.	Use conventional procedures, but, keep surface damp to avoid dust hazard.	Activity may be reduced to as low a level as may be desired.	Impractical for porous surfaces because of surface penetration by moisture.
Wet Sandblasting	Nonporous surfaces		Wet sandblasting is most practical on large surface areas. Collect used abrasive.		Contamination spread over area must be recovered.
Vacuum Blasting	Porous and nonporous surfaces.	Abrasion with controlled removal by vacuum suction.	Hold tool flush to surface to prevent escape of contamination.	Controlled disposal.	Contamination of equipment.
Vacuum Cleaning	Dry contaminated surfaces.	Removal of contaminated dust by suction.	Use conventional vacuum technique with efficient filter.	Good on dry porous surfaces. Avoids water reactions.	All dust must be filtered out of exhaust. Machine is contaminated.
Water	All nonporous surfaces (metal, paint, plastic, etc.). Not suitable for porous materials, such as wood, concrete, canvas, etc.	Solution and erosion.	Use gross decontamination employing water shot from high pressure hoses. Work from top to bottom to avoid recontamination; from upwind to avoid spray; 15 to 20 feet from the surface should be hosed at an incident angle of 30 to 45 degrees. Determine cleaning rate experimentally if possible. Otherwise, use a rate of 4 square feet per minute.	All water equipment may be utilized. Allows operation to be carried out from a distance. Contamination may be reduced by 50%. Water solutions of other decontaminating agents may utilize water equipment.	Drainage must be controlled. Porous materials will absorb contaminants. Oiled surfaces cannot be decontaminated. Not applicable on dry contaminated surfaces (use vacuum). Spray will be contaminated.
Detergents	Nonporous surfaces (especially painted or oiled surfaces).	Solution and erosion.	Work from top to bottom and from upwind. Clean surface at a rate of 4 square feet per minute. The cleaning efficiency of steam may be greatly increased by using detergents.	Steam reduces contamination by approximately 90% on painted surfaces.	Steam subject to same limitations as water. Spray hazard makes the wearing of waterproof outfits necessary.
Complexing Agents Oxalates Carbonates Citrates	Nonporous surfaces (especially unweathered surfaces; i.e., no rust or calcareous growth).	Forms soluble complexes with contaminated material.	Solution should contain 3% (by weight) of agent. Spray surface with solution. Keep surface moist for 30 minutes by spraying with solution periodically. After allotted time, flush material off with water. Agents may be used on vertical and overhead surfaces by employing mechanical foam.	Holds contamination in solution. Contamination (unweathered surfaces) reduced 75% in 4 minutes. Easily stored, carbonates and citrates are nontoxic, noncorrosive.	Requires application from 5 to 30 minutes. Little penetrating power; of small value on weathered surfaces.

3. In what sequence should personal protective equipment be removed?

4. How do you determine which method you should use to decontaminate equipment?

TABLE 2-2 (cont'd)

Method	Surfaces	Action	Technique	Advantages	Disadvantages
Organic Solvents	Nonporous surfaces (greasy or waxed surfaces, paint or plastic finishes, etc.).	Solution of organic materials (oil, piant, etc.).	Entire unit may be immersed in solvent. Also may be applied by standard wiping procedures. (See Detergents.)	Quick dissolving action. Recovery of solvent possible by distillation.	Requires good ventilation and fire precautions. Toxic to personnel. Material bulky.
Inorganic Acids	Metal surfaces, especially those with porous deposits (i.e. rust or calcareous growth). Circulatory pipe systems.	Strong dissolving power on metals and porous deposits.	Dip-bath technique is advisable for movable items. Acid should be kept at a concentration of from 1 to 2 normal (9 to 18% hydrochloric, 3 to 6% sulfuric acid). Reaction time on weathered surfaces should be 1 hour. Pipe systems, 2 to 4 hours. Afterwards, surface should be neutralized and rinsed.	Corrosive action on metal and porous deposits. Corrosive action may be moderated by addition of corrosion inhibitors to solution.	Good ventilation required because of toxicity and explosive gases. Acid mixtures should not be heated. Possibility of excessive corrosion if used without inhibitors. Sulfuric acid not effective on calcaerous deposits.
Acid Mixtures Hydrochloric Sulphuric Acetic Acid Citric Acid Acetates Citrates	Nonporous surfaces (especially those having porous deposits). Circulatory pipe systems.	Dissolving action.	Applied in same manner as inorganic acids. Mixture consists of: 0.1 gal. hydrochloric, 0.2 lb. sodium acetate, 1.0 gal. of water.	Dissolving action may reduce contamination 90% in 1 hour (unweathered surfaces).	Weathered surfaces may require prolonged treatment.
Caustics Lye (Sodium Hydroxide) Calcium Hydroxide Potassium Hydroxide	Painted surfaces (horizontal).	Dissolving power softens paint (harsh method).	Lye paint-removal mixture: 10 gal. water, 4 lb. lye, 6 lb. boiler compound, 0.75 lb. cornstarch. Allow lye paint-remover solution to remain on surface until paint is softened to the point where it may be washed off with water. Remove remaining paint with long-handled scrapers.	Minimum contact with contaminated surfaces. Easily stored.	Personnel danger (painful burns). Reaction slow; thus, it is not efficient on vertical surfaces or overheads. Should not be used on aluminum or magnesium. Method is difficult on vertical or overhead surfaces.
Tri Sodium Phosphate	Painted surfaces (vertical, overhead).	Dissolving power (mild method).	Hot 10% solution applied by standard wiping technique. (See Detergents) One-minute rub.	Reduces activity to tolerance in one or two applications.	Destructive effect on paint. Not to be used on aluminum or magnesium.

2-3. Environmental Health Service's Functions and Responsibilities

Environmental problems as a result of natural or other disasters cover a broad spectrum of problems, including those related to personal hygiene, water supply, food sanitation, waste disposal, and insect and rodent control. Remember, your first responsibility in any disaster situation will be to assist in patient care. Let's look at some basic public health considerations and your responsibilities in natural disaster environments.

807. Cite the Environmental Health Service's functions and responsibilities in natural disasters.

Field Sanitation. In almost every natural disaster situation we talk about establishing and maintaining good sanitation in the environment and in the treatment facility. We saw earlier how poor sanitation can lead to disease outbreaks. If improvised feeding and food sanitation equipment is required, only the basic minimum should be constructed the first day. This would include washing facilities and an open-fire cooking and heating facility. Subsequent items, might be a barrel oven, incinerator, and soakage pit, will normally be built later. You should be familiar with the use and construction of these as well as other basic field sanitation devices. Many of these were covered in Volume 1 of your CDC, The Control of Communicable Diseases in the chapter titled "Field Sanitation."

Disease Control. In other volumes of this course you learned ways to prevent and control the spread of disease. In disasters these same techniques can be used. Remember such things as good personal hygiene practices (hand washing), and giving immunizations (making people less susceptible), and isolating the infected people all help to break the chain of infection. You will be educating others—those who have the influence to institute control measures—about the disease process, its prevention and control, as well as monitoring disease outbreaks.

Food Supplies. Immediately following a disaster, measures should be taken to conserve available undamaged food supplies. A preliminary survey of damage as well as quarantine or placing on hold of all damaged foods is the first order of business following the start of recovery operations. Foods should also include water. Nothing should be moved until proper authorities have been advised. There will be enough confusion and lack of communication. You won't be able to get everywhere to look at all damage, so if all food—handling or storing facilities personnel realize the importance of this requirement, your task will be easier later.

Food in original sealed containers, such as tin cans and sealed waxed cartons, may be considered to be safe for use if external surfaces are carefully cleaned and monitored before opening. If available, Environmental Health Services personnel should assist in locating sources of wholesome food for the medical unit and patients. Feeding raw foods is to be discouraged. High standards of personal hygiene must be maintained by food handling personnel, who probably will be individuals placed into service for this duty and who have not been trained in the precautions required for mass feeding.

Some guidelines for field judgement in determining safety of foods following a disaster should be based on answers to these questions:

a. Was electricity off? If so, for how long?

b. In case of fire, what was used to extinguish the fire?

c. What is the disposition of salvageable products?

d. What arrangements have been made to remove "safe" food from location?

Sources of emergency food supplies. Emergency foods may be found on shelves in food establishments, etc. You should have a ready list of food handling, storage, and transportation facilities—i.e., warehouses, coldstorage areas, railroad cars, food-serving facilities, foil-pack kitchen, bakeries, processed food ready for distribution, vending machine locations, etc.—so that you're able to determine availability as well as the condition of food.

Canned fruit and fruit juices provide both water and nourishment; canned vegetables, soups, and canned or powdered milk are all excellent safe foods. Canned meat or fish and peanut butter are good nutrient sources, as are baby foods, raisins, chocolate, packaged cereals, and dried food. One of the first major problems to arise will be provision of milk, especially for infants. Adults and children a few months old can survive for many days without any milk at all. The present-day packaged and canned foods for infants provide adequate emergency substitutes for milk. All fresh milk should be boiled, if pasteurization plants and adequate transportation for distribution are missing. The production of questionable milk supplies must be closely watched. After the survival phase, adequate food can be obtained from other sources outside the disaster area.

Protective measures. Protective measures should include the protection of existing supplies from waste and destruction by rodents and other vermin and close sanitary surveillance to prevent foodborne disease outbreaks. No matter what type of disaster, certain food items cannot be kept but must be destroyed. When foods are destroyed, the Property Disposal Officer *must* assure that these items are either burned or buried. The danger of these nonwholesome food items getting into the hands of needy victims of the same disaster must be guarded against.

Examples of merchandise that should be destroyed and cannot be reconditioned or have no salvage value are: produce; coffee and tea in bags; flour, meal, cereals, beans, wheat and whole unprocessed grains; confectionary sugar; nuts (salted, shelled or shell nuts); screw-top, crimped-cap, and similar containers when water affected; heat-damaged food items that were noticeably charred or that were in the immediate proximity of the fire; and foods subjected to direct contact with nonpotable waters. Table 2-3 shows the disposition and recommendations for smoke- and flood-damaged foods as suggested by the Food and Drug Administration.

Some additional protective measures include the development of instructions to inform personnel how

Table 2-3
DISPOSITION OF SMOKE AND FLOOD DAMAGED FOODS

Type of Food	Problem	Disposition
Meats	Smoke damage resulting in insoluble tars and plastics penetrating product	Dispose of or salvage under USDA guidance as tankage for animal feed
	Flood damage	Dispose of; denature or render if it can be properly supervised
Butter, cheese and fats	Smoke damage resulting in "off" taste and odor	Dispose of
	Flood damage	If in large quantities salvage for glycerine and soap making with proper control
Salt, sugar, dried milk, powdered eggs (bagged)	Flood damage	Destroy if product altered; if bags only damp and with salt or sugar, can be recrystallized. Dried milk, powdered eggs can be used for stock feeding after mixing with grains and heat treatment
Produce	Smoke damage	Dispose of
Syrup, molasses, honey	Flood damage resulting in unsafe water penetrating lid seal	Dispose of
Canned goods	Flood damage to commercially processed foods with hermetically sealed metal cans or cans with key when the key is removed and key tab is lifted and cleaned underneath	Salvage by scrubbing silt from cans which have had labels removed; rinse; and sanitize in 200 ppm chlorine solution; air dry or wipe dry to prevent rust; relabel cans
Home canned food	Flood damage	Dispose of
Dishes, kitchen utensils	Flood damage	Wash thoroughly; sanitize in 200 ppm chlorine solution if china or glass; by boiling in water if metal
Hard rubber equipment	Flood damage	Wash thoroughly; sanitize in 200 ppm chlorine solution

perishable foods can be preserved for longer periods in the field and the proper location of eating areas. Sites selected for feeding areas should be level and have good natural drainage.

Exercises (807):

1. Cite the responsibilities of the Environmental Health Service in natural disasters.

2. State things you should consider in determining if food is safe for consumption following a disaster.

3. What are some sources of emergency food supplies?

4. Cite protective measures for ensuring the sanitation of food after a natural disaster.

Nuclear Warfare

SOPHISTICATED weapons systems, both conventional and NBC (nuclear, biological, and chemical), are widely available among the U.S., its allies, and the threat nations. The threat nations are capable of employing weapons in large numbers, and they have delivery systems with great mobility and range. NBC weapons are viewed by the threat nations as "weapons of mass destruction." Heavy emphasis is placed on nuclear and chemical warfare—an alternate means in conventional warfare—to achieve surprise, decisive force, and deep penetration and maneuverability.

Nuclear weapons are similar to those of more conventional types in that their destructive action is due mainly to blast or shock. On the other hand, there are several basic differences between nuclear and high-explosive weapons. First, nuclear explosions can be many thousands (or millions) of times more powerful than the largest conventional detonations. Second, a fairly large proportion of the energy in a nuclear explosion is emitted in the form of light and heat, usually referred to as "thermal radiation." The thermal radiation can cause fires to start at a distance of 20 miles from ground zero (GZ) when a 10-megaton weapon is detonated at the optimum burst height. Third, the nuclear explosion is accompanied by highly penetrating and harmful invisible rays, called "initial nuclear radiation." Initial radiation presents a potential hazard at a great distance from the point of detonation. Finally, the substances remaining after a nuclear explosion are radioactive, emitting similar radiations over an extended period of time. This contamination is known as the "residual nuclear radiation" or "radioactive fallout."

3-1. Medical Aspects of Nuclear Weapon Detonation

You already have read about the hazards associated with "peacetime" nuclear weapon accidents. The radiation is in the same form as that which you have already studied—alpha, beta, gamma, and neutrons. The difference is the magnitude and severity of the hazard. For you to understand the medical aspects of a nuclear weapon detonation we must describe for you what happens when one of these weapons explodes. We will discuss the effects of the blast, fire hazards, and the effects of the burst as it relates to the amount of the radioactive material produced. There are three general types of injuries (table 3-1) resulting from the detonation of a nuclear weapon: blast injuries, heat related injuries, and radiation induced injuries. Additionally, flash injuries (resulting in blindness) will be experienced by personnel many miles away from the actual point of detonation.

808. Describe the effects of a nuclear weapon detonation.

Blast. At a fraction of a second after a nuclear detonation, a high-pressure wave develops and moves outward from the fireball. This is the blast wave and is the cause of most of the destruction accompanying a nuclear burst. The front of the wave travels rapidly away from the fireball, behaving like a moving wall of highly compressed air. As an example of the speed of the blast wave, consider the following: After a lapse of 10 seconds, when the fireball of a 1-megaton burst has attained its maximum size, the front of the blast wave has already traveled over 5 kilometers. At 50 seconds after the burst, when the fireball is no longer visible, the blast wave has traveled about 19 kilometers and is still moving slightly faster than the speed of sound.

There are strong winds associated with the passage of the blast wave. These winds may have a peak velocity of several hundred miles an hour near ground zero. The overpressure—i.e., the pressure in excess of the normal atmospheric pressure, as well as the winds—is a major contributor to the casualty and damage-producing effects of the nuclear detonation. The overpressure can cause immediate death or injury to individuals and damage to material by its crushing effect. The high-speed winds propel objects, such as tree limbs or debris, at great speed, turning them into potentially lethal missiles.

These winds can also physically throw, at great speeds, any individual who is not protected, resulting in casualties. Individuals both inside and outside of a structure may be injured as a result of blast damage to that structure—those inside by the collapse of the structure and fire, and those outside by the flying objects carried by the winds.

Fire Hazards. Scientists have stated that about one-third of the total energy in a nuclear explosion is in the form of heat radiation. The fireball resulting from a nuclear detonation yields heat estimated to be greater than the center of the sun (several million degrees Celsius). The heat at ground zero of a nuclear airburst probably exceeds 2500°C. for about 3 seconds. At Hiroshima the heat energy ignited clothing, grass, and dry wood at distances ranging to 3500 feet from ground zero.

Both primary and secondary fires result from a nuclear explosion. Primary fires are ignited by the initial heat wave of the detonation. Secondary fires are caused indirectly by the blast. Such indirect causes are overturned stoves, broken gas pipes, electrical short circuits,

TABLE 3-1
EXPECTANT INJURIES FROM NUCLEAR WEAPONS

Nuclear Effect Causing Injury	Expectant Patients in Percent	Type of Injury
Light	35	Flash blindness, dazzle, retinal burns, inflammation of eyes
Heat		Flash burns, contact burns
Blast	50	Direct blast injury, missile injury, wind blast, lung over pressure injury
Radiation	15	Injury is dependent upon total exposure (dose in RADs).

and so on.

It is very difficult to ascertain how many primary or secondary fires may be caused by a nuclear explosion or how serious these fires may become. The number of fires varies according to the season, atmospheric conditions, type of terrain, type of burst, weapon yield or size, and many other equally important factors. It is speculated, however, that within one-half mile from ground zero of a 20-kiloton (KT) explosion there will be an area of nearly complete destruction in which mass fires or conflagrations may be expected in the first hour (table 3-2). Within 1 mile from ground zero many secondary fires and considerable fire spread may be anticipated. These distances apply only in the detonation of a 20-kiloton nuclear weapon. The effects of higher yield weapons are of course much greater.

Effects of Burst. Radioactive contaminants are fission products, unfissioned nuclear components, and materials in which radioactivity was induced. Radioactive contaminants cannot be made safe by chemical action. They must be removed, shielded, or allowed to decay to safe levels. The first step in protection against radiation is the recognition of the hazard. Of the three types of bursts—air, surface, and subsurface—the air burst will produce little or no radiological hazard on the ground, the surface blast will be accompanied by considerable radiological hazard at ground zero and downwind areas, and the subsurface burst will produce an intense radiological hazard. Areas radiologically contaminated by either surface or subsurface bursts must be surveyed to determine the extent and degree of contamination. The radioactive contamination from nuclear bursts consists of finely divided particles which have attached themselves to larger dust particles or water particles. This material behaves physically like any other dirt or moisture. In fact, the phenomenon of radioactive contamination is exactly the same as getting dirty except that in the case of radioactive contamination, very small amounts of dirt are required and the "dirt" is radioactive.

Exercises (808):

1. How can people be hurt from the "blast" of a nuclear weapon detonation?

2. What types of fires would be caused by a nuclear weapon detonation?

3. How much radiological hazard would an air burst produce on the ground?

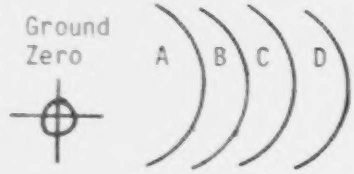
4. Which type of burst yields the most ground level contamination?

5. How does the nuclear burst result in radioactive contamination?

3-2. Radiation Detection

An initial survey of any radiological contaminated area is accomplished to determine the extent of the hazards. Although you are not responsible for making this survey, you may be advising personnel performing these tasks on the radiological health hazards involved.

TABLE 3-2
DISTANCE OF DAMAGE ZONES IN MILES FROM GROUND ZERO

Weapon Size	Radius of Destruction/Damage Zone				Diagram of Zones
	A (Total)	B (Severe)	C (Moderate)	D (Light)	
20 KT	0.5	1.0	1.5	2.0	
100 KT	1.0	2.0	3.0	4.0	
1 MT	2.0	4.0	6.0	8.0	
5 MT	3.0	6.0	9.0	12.0	
10 MT	4.0	8.0	12.0	16.0	
20 MT	5.0	10.0	15.0	20.0	

*Note: Radius is based on an air blast and the cube root scaling principle; 3/4 of the above values may be used for a ground blast.
1 Kiloton (KT)= Explosive force of 1,000 tons of TNT.
1 Megaton (MT)= Explosive force of 1,000,000 tons of TNT.

Additionally, you may have to enter contaminated areas to survey and retrieve needed food supplies. This is why you must understand and be able to perform basic radiation detection.

809. Identify methods of radiation detection.

Radiological Survey. The most rapid means of estimating the extent of radiological hazards is by an aerial survey utilizing helicopters or slow flying aircraft. This provides immediate but incomplete information concerning radiation intensity and general area contamination. Ground surveys supplement this preliminary aerial survey in order to outline the exact danger perimeter. This is the outer border (or edge) in which a person would receive a dosage greater than the maximum permissible dose within a certain period of time. The total exposure permissable dose rate is established by the commanding officer with consultation from the base medical director. Decontamination is closely associated with monitoring. Close cooperation between monitors and decontamination personnel is required to avoid wasted effort or unnecessary hazards. Every effort must be made to control any spread of contamination during both monitoring and decontamination procedures. This can be accomplished by:

a. Always working in toward the center of the contamination.

b. Taking care not to track the contamination. This implies complete knowledge of where the contamination lies and proper use of protective clothing, especially shoe covers.

c. Covering clean areas in the vicinity with paper or roofing materials.

d. Being aware that the runoff solutions and all mops, rags, scrub brushes, etc., used in decontaminating are potentially contaminated.

e. Ensuring a clear, rapid drainage to carry off water used for washing away contamination.

f. Providing a change station or personnel decontamination center with associated monitoring and laundering facilities.

g. Preventing access to particularly hot areas.

h. Using great care in disposing contaminated objects.

i. Carrying out proper ventilation procedures by using ventilation system filters and/or protective masks for personnel.

Radiation Measurement. People are not equipped by nature to sense the presence of hazardous ionizing radiation. Nor is the human body naturally protected against radiation. Therefore, since we have elected to generate and amplify radiation hazards, we must also equip ourselves with the knowledge and means for detection and protection. The information in this section will help you understand how radiation detection instruments operate and what specific purposes they serve.

Components of Radiation. The components of radiation which our equipment will detect are alpha particles, beta particles, and gamma photons. We will look at each component with reference to its detectability.

Alpha. This particle consists of two protons and two neutrons which are emitted from the nucleus of an unstable atom. An alpha particle travels only a few centimeters in air and can be stopped by a piece of paper. Because of its large size, positive charge, and slow speed of travel (compared to beta and gamma) it can cause numerous ion pairs (discussed in a later paragraph).

Beta. This particle is a high speed electron which is emitted from the nucleus of an atom. Its range in air is roughly 15 feet but varies based upon energy levels. Beta does not have enough penetrating power to pass through most metals (e.g., aluminum). Beta can, however, penetrate clothing and skin.

Gamma. Gamma photons are extremely powerful and have a range of thousands of meters in the air. Gamma rays can easily penetrate most materials; lead (or lead equivalent—5.8 cm leads equal shielding power of 30 cm of concrete) must be used for shielding purposes.

Units of measurement. All radiation detection equipment is usually referred to as RADIAC equipment. This acronym is formed from:

R—Radio
A—Activity
D—Detection
I—Identification
A—And
C—Computation

The readings you will obtain using the various RADIAC instruments will vary from one instrument to another. It is important that you understand the meaning of each unit of measurement as well as the differences between them. The following definitions have been simplified from the actual scientific explanations.

Roentgen. (pronounced—rent'gen) This term is the international unit for measuring x rays or gamma rays. By analogy a roentgen is a unit of radiation like a minute is a unit of time.

Milliroentgen. This is 1/1,000 of a roentgen.

REM. This acronym comes from roentgen equivalent in man. It is important to remember that the various components of radiation react differently with various materials. This term takes into account the absorbed amount of radiation and the relative biological effect from that amount (the same effect that would result from 1 roentgen of x ray or gamma). This term considers how radiation acts on humans.

Millirem. This is 1/1,000 of one REM.

NOTE: For the purposes of radiation detection the roentgen and the REM are approximately equivalent levels of radiation.

Ionization. "Ionization" is the process whereby one or more electrons are removed from a neutral atom by the action of radiation. This process produces an ion pair. The best way to explain this process is by using visual support. Let's begin with a simple atom of helium (fig. 3-1). In its naturally occuring form, this atom is very stable because its charges (combination of positives and negatives) equal out or are in balance. Now, let's say we expose this helium atom to some form of ionizing radiation—for example alpha, beta, gamma. For this example let's use a gamma photon (ray) (fig. 3-2). The gamma photon strikes into one of the electrons and knocks it out of orbit (fig. 3-3). The result is one positively charged helium particle (ion) because it now has more positives than negatives, plus one negatively charged electron.

The combination of these two items is called an ion pair. Because of their respective electrical charges we can manipulate their resulting actions to detect how much ionization is going on.

Principle detection methods. Now we will discuss the various methods of detecting radiation. The individual pieces of RADIAC equipment will be explained in later paragraphs. Let's start with the phrase "detection methods." This phrase simply means how the RADIAC equipment is designed to interact with radiation to give you readings. It is important that you are comfortable with these detection methods because once you understand "why" the equipment works, you will be able to use it more efficiently. The four methods of detection common to Air Force RADIAC equipment are photodosimetry, gas ionization, scintillation, and thermoluminescence, which are covered in the following paragraphs.

Photodosimetry. Darkening of photographic plates by radiation from radioactive sources was the first method used to detect nuclear radiation. Photographic films for measuring radiation are now used primarily for personnel monitoring, often for area surveys, and sometimes in industrial x ray applications. Ionizing radiation will penetrate the blank film and leave a tiny exposed area where it has passed through. The film can then be placed over a light source, and the amount of light that shines through the film is measured and calculated into radiation level readings. (NOTE: Alpha particles will not penetrate the paper packaging in which the film stays wrapped.)

Gas ionization. This method uses the production of ion pairs in an inert gas, such as argon, to produce readings. The ion pairs, because of their electrical charges, are attracted to parts of the equipment which have been set with opposite electrical charges. This causes a current flow in the equipment and the needle on the meter responds to the current flow. The needle fluctuation has been calibrated to correspond to a certain level of ionizing radiation.

Scintillation. Scintillation survey instruments (counters) depend upon the light produced when ionizing radiation reacts with a phosphor or crystal. A

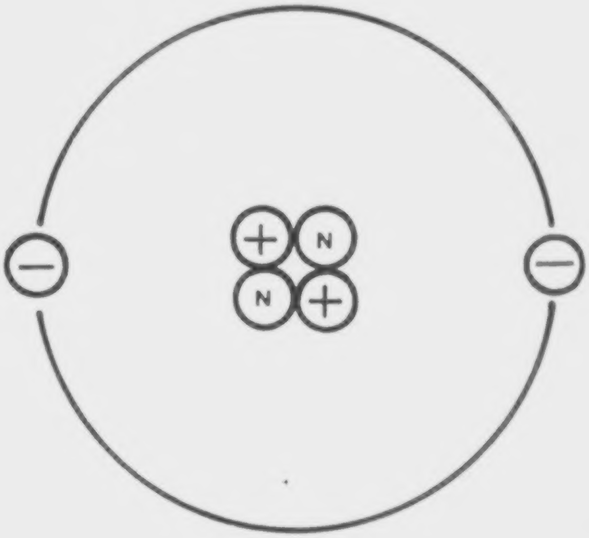


Figure 3-1. A helium atom which consists of protons which have a positive (+) electrical charge; neutrons (N) which have no electrical charge; and electrons which have a negative ( ) electrical charge.

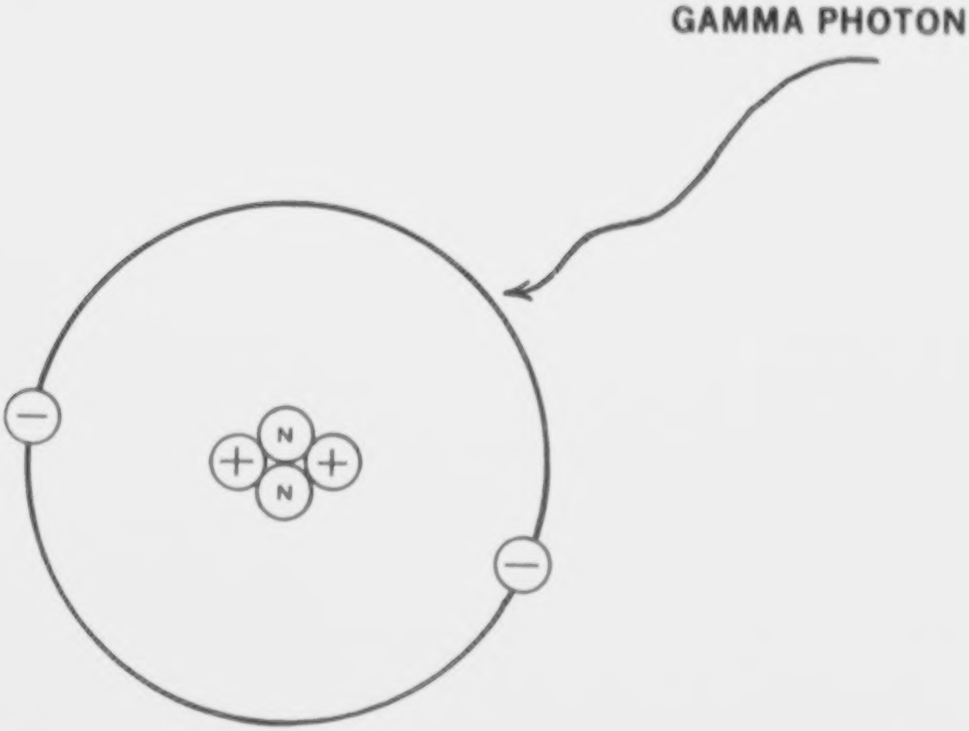


Figure 3-2. Helium atom exposed to ionizing radiation.

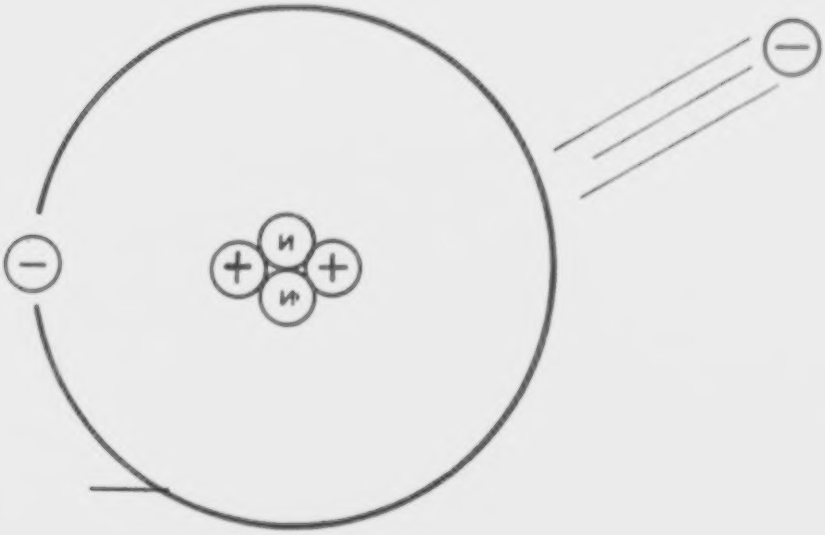


Figure 3-3. Effect of ionizing radiation on a helium atom.

photomultiplier tube converts the light to electrical impulses which are amplified and registered on a meter. The dial reads in terms of counts per minute or milliroentgens per hour (mr/hr). The scintillation counter may be used to survey for alpha, beta, gamma, and x radiation. Scintillation counters are used in the Air Force specifically for alpha detection. The may be used to survey for very low levels of radiation with high accuracy.

Thermoluminescence. The process of thermoluminescence happens because certain materials (crystals) can absorb and store energy from ionizing radiation and release this energy as light when the material is heated. Irradiation of a luminescent material results in the excitation of its electrons. The electrons are then trapped in this excited state and appear as imperfections in the crystal. The electrons stored in this excited state are reactivated by heating the crystal. When heated, the crystal gives off light. The amount of light released is measured to determine the amount of radiation received.

Survey instruments. Survey instruments may basically be defined as devices that translate radiation into voltage or current which may then be read on a meter. Various types of instruments are required to detect and measure different types and quantities of radiation. There is no acceptable universal detection or measuring device; hence, you must become familiar with many different instruments.

RADIAC devices can generally be divided into two different categories. These two categories or groupings are:

a. Total dose. These instruments are used to register an accumulated amount of radiation exposure. Simply stated, the pocket dosimeter and/or film badge will continually add up exposure amounts regardless of time factors.

b. Dose rate. These instruments are used to measure radiation levels in specific periods of time. For example, the AN/PDR-27 measures gamma radiation in milliroentgens per hour (mr/hr), and the PAC-1S measures alpha radiation in counts per minute (cpm). An estimate of an individual's total dose can be determined by multiplying the dose rate times the period of exposure:

50 mr/hr (dose rate-reading)
• 2 hrs (time exposed)
100 mr (total dose)

Total dose instruments. Pocket dosimeters and ion chambers are direct reading instruments used to give the wearer an estimate of exposure to x or gamma radiation, while receiving the dose. This enables the person to limit exposure to the permissable level.

a. Pocket dosimeters. A pocket dosimeter (fig. 3-4) is nothing more than a miniature quartz fiber electroscope (a movable electrode and an optical system), roughly the size of a fountain pen. Action can be viewed through the microscope type lens as a hairline crossing a calibrated scale. The dose can be read directly from the scale. Individual dosimeters are usually limited in their range. Several ranges are available, such as 0.05 to 0.49 roentgens, 0.50 to 4.9 roentgens, and 5 to 49 roentgens.

b. Thermoluminescence dosimeters (TLD). TLD badges (fig. 3-5) record x ray, gamma, and beta radiation. These badges do not detect alpha or any non-ionizing radiation such as radiofrequency, microwave, or ultraviolet radiation. This instrument can be reused, and because of this, once it is analyzed, the information which was recorded on the internal thermoluminescence crystals (or elements) (fig. 3-6) is removed. Thermoluminescent dosimeters have been accepted as a replacement for film badges in the Air Force as well as by the Public Health Service and some civilian nuclear agencies. Special TLD badges are designed to measure neutron radiation.

Dose rate instruments. As stated before, these are instruments that measure radiation over a specific period of time. The dose rate instruments we will discuss are the main ones you will probably be using at your base—i.e., the AN/PDR-27, 43, and 56; the CDV 715; and the PAC-1S (or AN/PDR-60).

The importance of having properly operating RADIAC equipment cannot be overstressed. This equipment is the only way you will be able to determine the types and amounts of radiation present. This knowledge is essential in medical operations during and after a nuclear attack as well as in peacetime radiation accidents. In this section you will read about the basic description, operation, and maintenance of these instruments. More specific information concerning the actual operation, inspection, and calibration of RADIAC instruments can be found in the appropriate technical order for each one (see Appendix A).

a. AN/PDR-27 Series. The AN/PDR-27 (fig. 3-7) is a gas ionization instrument that detects and measures low levels of x ray and gamma radiation. Additionally, it can detect low levels of beta radiation but is not capable of accurate beta measurement. Because its maximum capacity is only one-half roentgen per hour (500 milliorentgen per hour) it may become over saturated and read zero in radiation fields above this level. The high sensitivity, extendable probe, beta detection, and earphone capbility make this an ideal personnel monitoring instrument. When measuring gamma radiation, the detector probe can be used in or out of the well (housing); beta radiations, however, can only be detected when the detector probe is removed from the well and the beta shield on the probe is moved aside.

The range of field intensities capable of being detected by this RADIAC set is relatively broad. Therefore, in order to provide an easily observable meter deflection for any value of field intensity within the operating range of the set, four ranges of sensitivity are provided. Any one range may be selected by means of a switch on the RADIAC meter panel.

Subzero temperature and climatic conditions associated with cold weather affect the efficient operation of this equipment. The additional instructions and precautions for operation of the instrument under such adverse conditions are as follows.

(1) Handle the equipment carefully.

(2) Keep the instrument warm and dry. If necessary, construct an insulated box for the set.

(3) Allow at least two minutes for the tubes to warm up the selector switch in the SET position.

(4) When the equipment has been exposed to cold, and

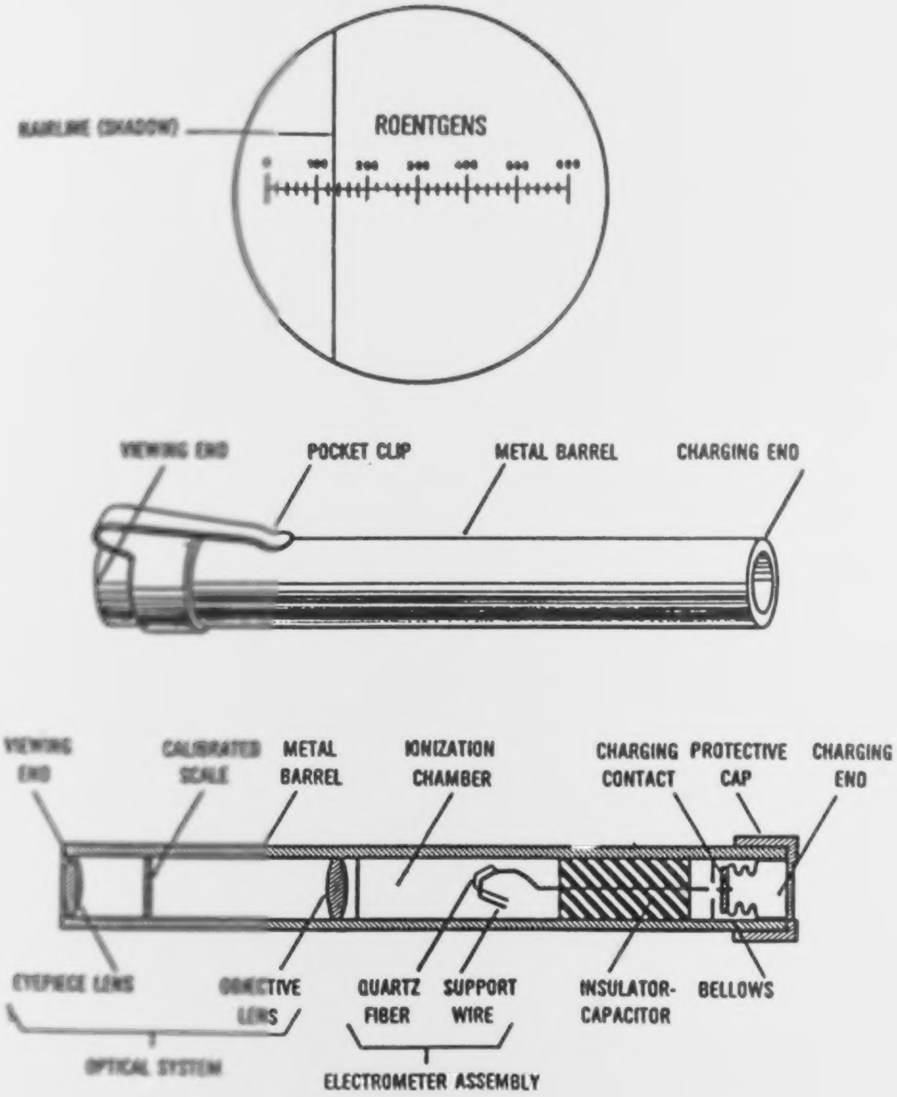


Figure 3-4. Pocket dosimeter.

it is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. This condition also occurs when the equipment warms up during the day after it has been exposed to the weather during a cold night. In either event the set must be thoroughly dried.

(5) Use any improvised means to protect the dry batteries, since they will fail if not protected against the cold. If necessary, preheat the batteries to room temperature. Store spare batteries in bags lined with kapok, spun glass fiber materials, animal skin, or woolen clothing.

This equipment also may be used in the tropics where heat and moisture conditions are more severe than normal. The high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the surrounding air. To avoid moisture seeping into the set, make sure all mounting screws on the front panel are tight.

Conditions similar to those encountered in tropical climates often prevail in desert areas. The main problem which arises, however, is the large amount of sand or dirt that may enter the equipment. Keep the equipment as clean as possible.

b. AN/PDR-43. The AN/PDR-43 (fig. 3-8) is also a gas ionization detector which measures gamma radiation levels and detects beta particles. It is a high range instrument and is therefore useful in fields of high radiation (levels up to 500 roentgens per hour) since it will not saturate. It is recommended as a companion for the AN/PDR-27.

c. CDV-715. The CDV-715, 0-500 r/hr survey

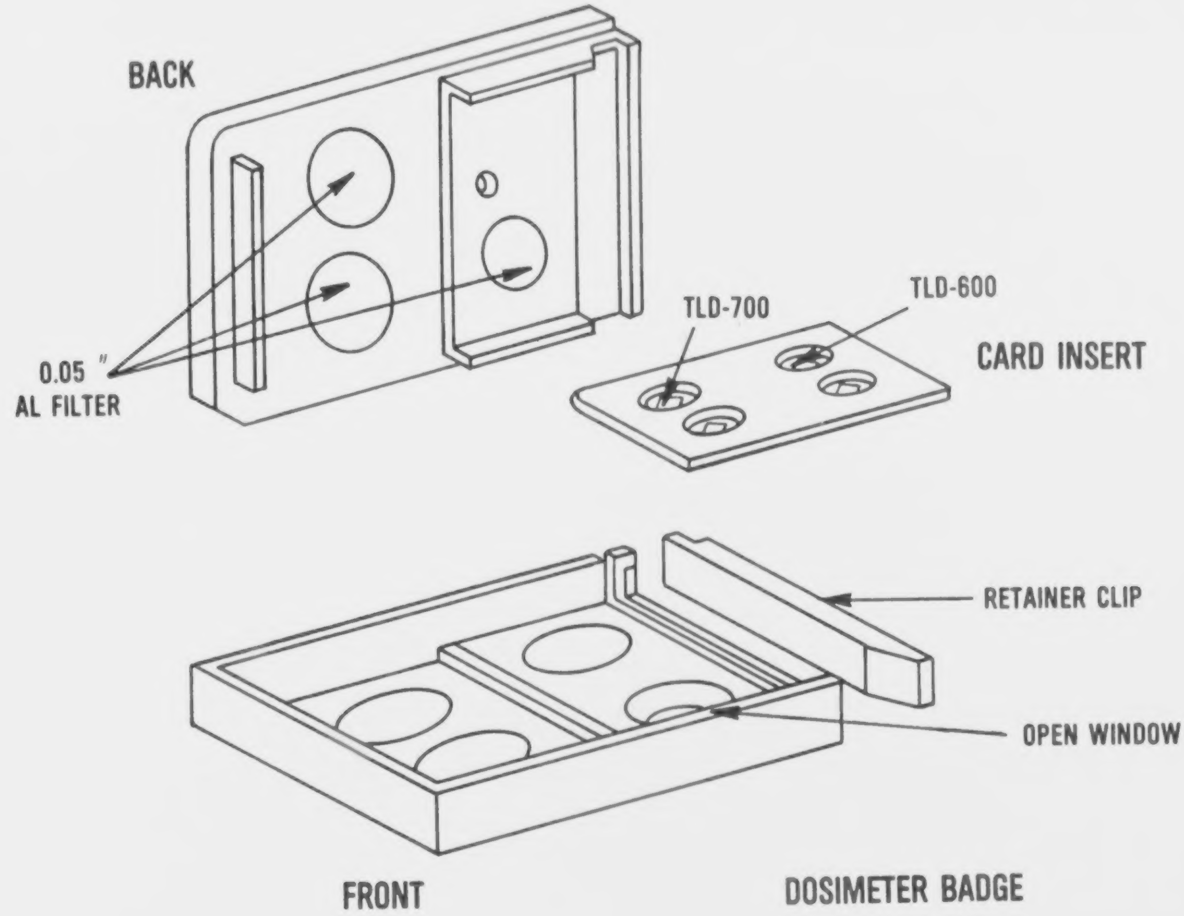


Figure 3-5. TLD dosimeter badge.

meter, will measure gamma dose rates only and is used for general post-attack operations. It is designed (1) for ground survey, (2) for use in fallout monitoring stations and community shelters, and (3) as an interim aerial survey instrument. This instrument has no beta detection capability.

d. PAC-1S. The PAC-1S series RADIAC instruments are a family of detectors used for detection of alpha particles. The most common model found in Air Force facilities is the PAC-1S-1 (fig. 3-9). The PAC-1S uses a detachable probe with a very thin, delicate mylar face. To detect alpha particles the probe face must be held approximately 1/8 inch from the surface being monitored. The mylar probe face is easily damaged, however, which will cause a light leak and false readings. Also when monitoring with the PAC-1S, the probe face must be held stationary for several seconds to allow the instrument to respond. It may become saturated in fields of high radiation and give a negative reading.

The instrument is calibrated to present a meter reading of the counts per minute of alpha radiation under the active area of the probe. Four reading scales are used. Their ranges are 0 to 2000, 0 to 20,000, 0 to 200,000, and 0 to 2,000,000 counts per minute (cpm).

You should become familar with the following important details concerning alpha particles in order to obtain accurate readings from the PAC-1S instrument.

(1) Because of their large mass, alpha particles travel in straight paths, radiating in all directions from their source. Energy is lost by collisions with air molecules. With their energy expended, forward progress stops and

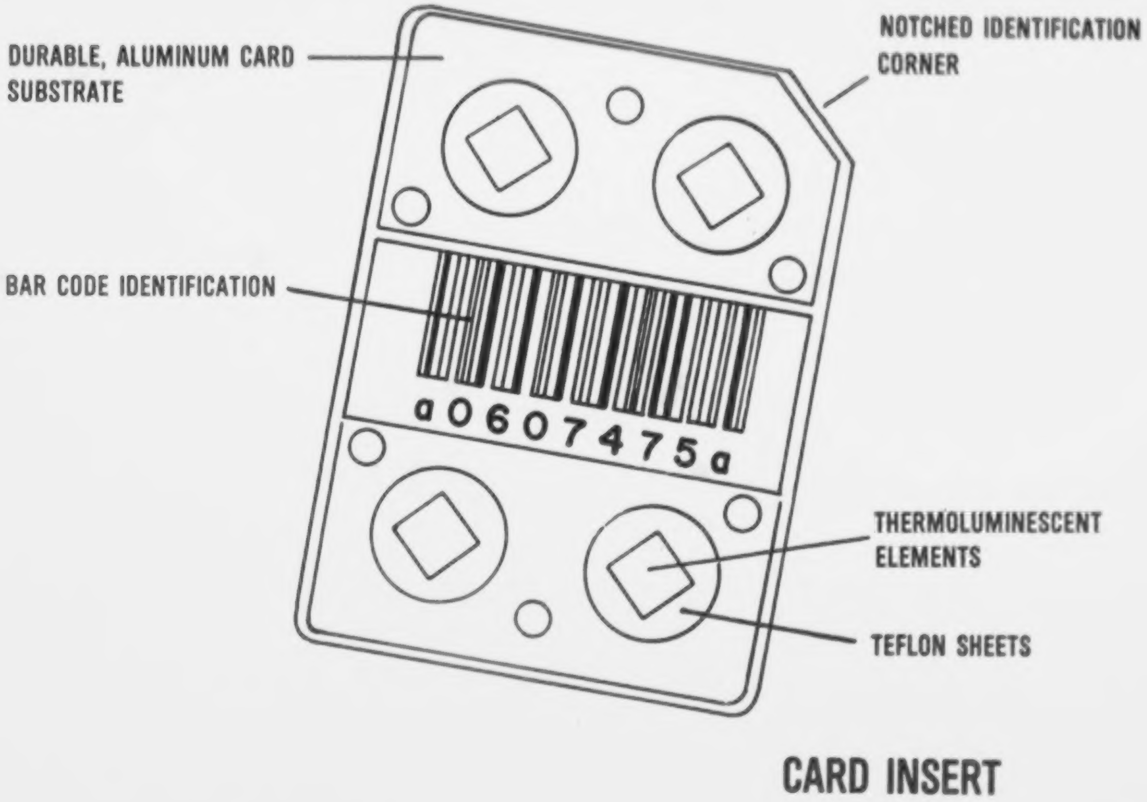

DURABLE, ALUMINUM CARD SUBSTRATE
NOTCHED IDENTIFICATION CORNER
BAR CODE IDENTIFICATION
a0607475a
THERMOLUMINESCENT ELEMENTS
TEFLON SHEETS
CARD INSERT

Figure 3-6. Card insert for TLD badge.

the alpha particles are no longer detectable.

(2) The maximum range of alpha particles depends on their energy. Under standard conditions, the maximum range of alpha particles from plutonium 239 to 1.4 inches in air. The maximum range of alpha particles from uranium 238 is 1.06 inches.

(3) Water, paper, and animal tissue reduce the range by approximately 1/1000 of that of air. Uranium 238 alpha particles penetrate about .001 inch of water, paper, or animal tissue. Plutonium 239 alpha particles will penetrate about .0014 inch.

(4) A wet surface resulting from rain or early morning dew on the ground, on a truck, or on any surface cannot be monitored successfully. Heavy dust conditions can prevent a correct reading by dust settling over the contaminated area. A sheet of ordinary paper the thickness of approximately .004 inch will block out nearly all alpha particles. The operator must keep these facts in mind when monitoring any area.

(5) Another important factor is that alpha particles travel in every direction when emitted from their source. Figure 3-10 illustrates a cross section view of the approximate pattern of alpha emission from the source. Each line represents the trail of an individual particle showing the relative range and angle. It can be seen that it may be exceedingly difficult to detect alpha contamination under some conditions with the instrument working properly because of the characteristics of the alpha activity itself. Thus, it is important that you hold the probe face one-eighth inch and parallel to the surface being surveyed to achieve maximum accuracy.

e. AN/PDR-56A. This instrument (fig. 3-11) has been chosen by the Air Force to replace the aging PAC-1S as the primary alpha monitoring instrument. Like the PAC-1S, this instrument has a detachable probe with a mylar face. It also has an x ray probe which will detect the low energy x ray emitted in alpha decay, making the instrument more versatile. This probe should be used to detect alpha contamination of unprotected food supplies.

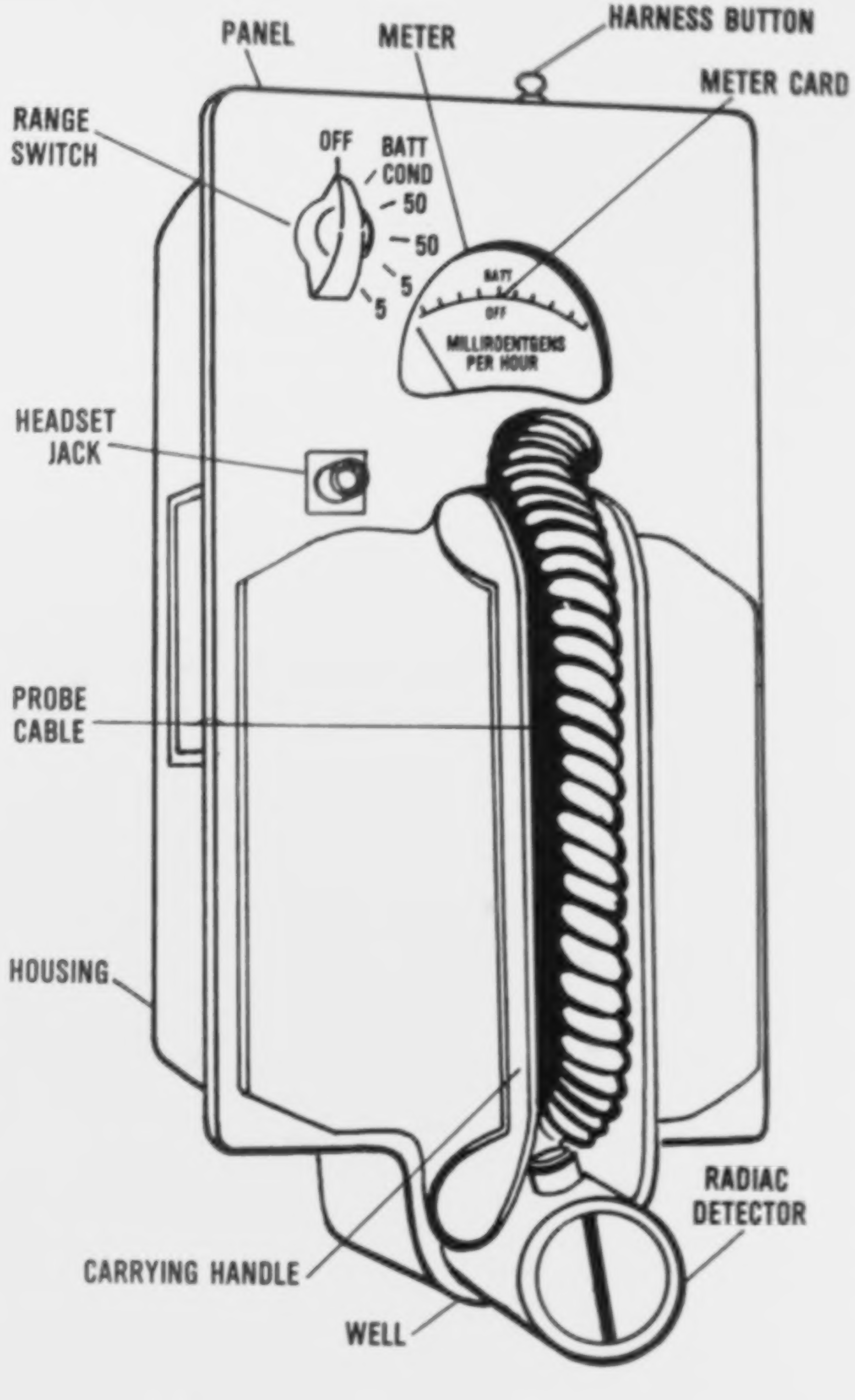


Figure 3-7. RADIAC meter AN/PDR-27C, front view.

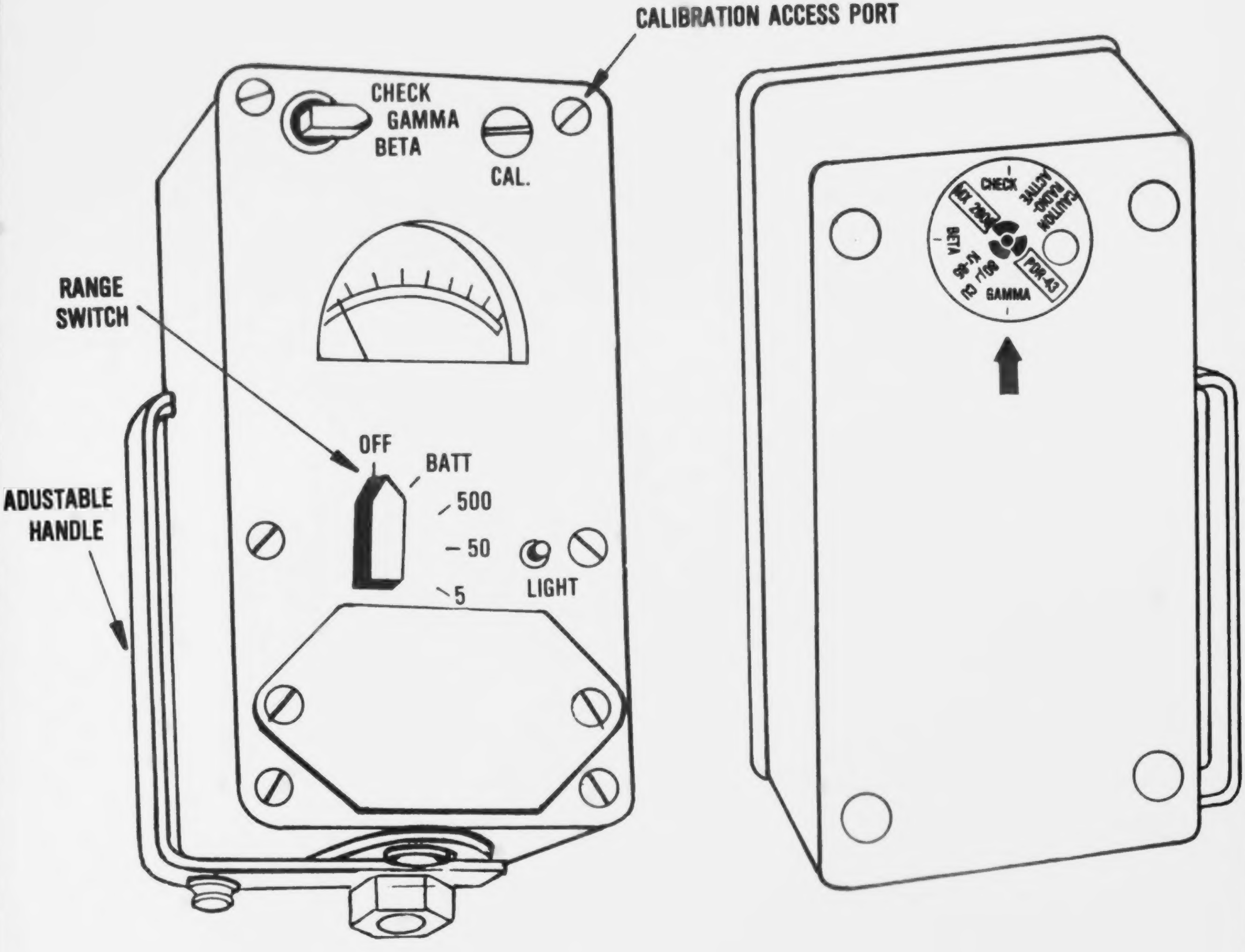


Figure 3-8. RADIAC meter AN/PDR-43 to and bottom view.

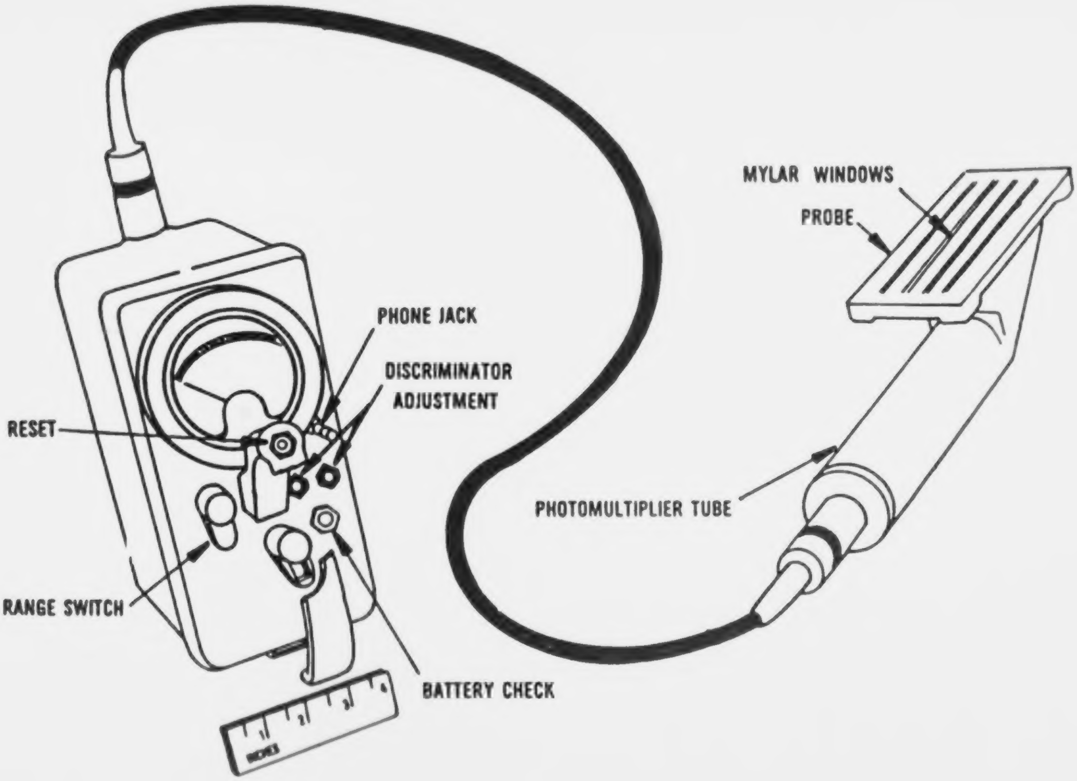


Figure 3-9. The PAC-1S-1 alpha scintillation detector.

Exercises (809):

1. What does the term RADIAC mean?

2. Name the two different groups of RADIAC devices.

3. What are two types of total dose instruments?

4. The AN/PDR-27 is capable of measuring what types of radiation?

5. How do you measure beta radiation using the AN/PDR-27?

6. State four additional precautions when operating the AN/PDR-27 in arctic climates.

7. What RADIAC instrument would be used to measure gamma radiation up to intensities of 500 r/hr?

8. What type of radiation will the CDV-715 measure?

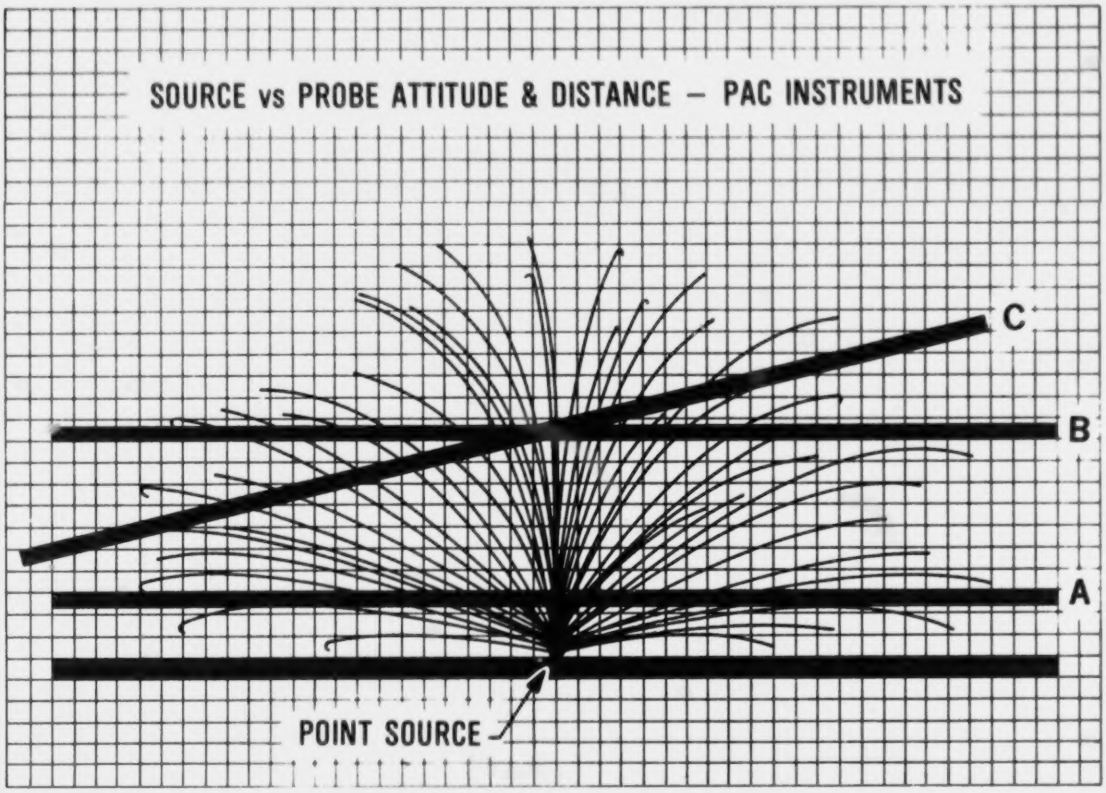
9. Name the primary alpha monitoring instrument.

10. What is the unit of measurement that the PAC-1S records radioactivity?

11. What effect will rain have on the effectiveness of monitoring alpha contamination with the PAC-1S?

3-3. Personal Protective Devices

Individual protection is everybody's job. The Air Force has provided various types of equipment to assist you in saving your life during an emergency. Knowledge



A = PROPER PROBE ATTITUDE (ANGLE) AND DISTANCE (1/8 INCH)

B = TOO HIGH

C = TOO HIGH, WRONG ATTITUDE

Figure 3-10. Correlation of efficiency vs. distance from source in alpha monitoring.

of the proper use and care of this equipment will greatly reduce the possibility of your becoming a casualty in the event of an enemy attack or a peacetime accident.

There are two general types of protective clothing, permeable and impermeable. Protective masks are used with either type. Hoods, shoes, boots, gloves, and aprons are included in both the permeable and impermeable outfits.

810. Specify the effectiveness and proper use of protective equipment.

Permeable Protective Clothing. Permeable protective clothing allows the passage of air through its fabric. It is clothing that has been impregnated with chemicals (activated charcoal) that neutralize vapors and very fine sprays of chemical agents. This clothing does not protect against large drops or splashes of liquid chemical agents that may wet the clothing. When clothing is so contaminated, the wearer must immediately take off the garment or rip off the portion that has been wetted to prevent continued contact of a concentration of the liquid chemical agent with his or her skin. Permeable protective clothing affords no protection against gamma radiation.

Use. Permeable protective clothing is intended primarily for protection of personnel exposed to field concentrations of chemical agents. It will be issued to personnel when the situation is such that employment of chemical agents is likely. Impregnated outer garments must not be used as rain gear because the absorption of water renders the clothing less effective for its intended use and causes deterioration of the fabric.

Wearability. The wearing quality of clothing is not affected by impregnation. The slight increase in garment weight may cause light discomfort to the wearer, but this factor will not materially lessen the person's efficiency. Impregnated clothing should not be worn longer than

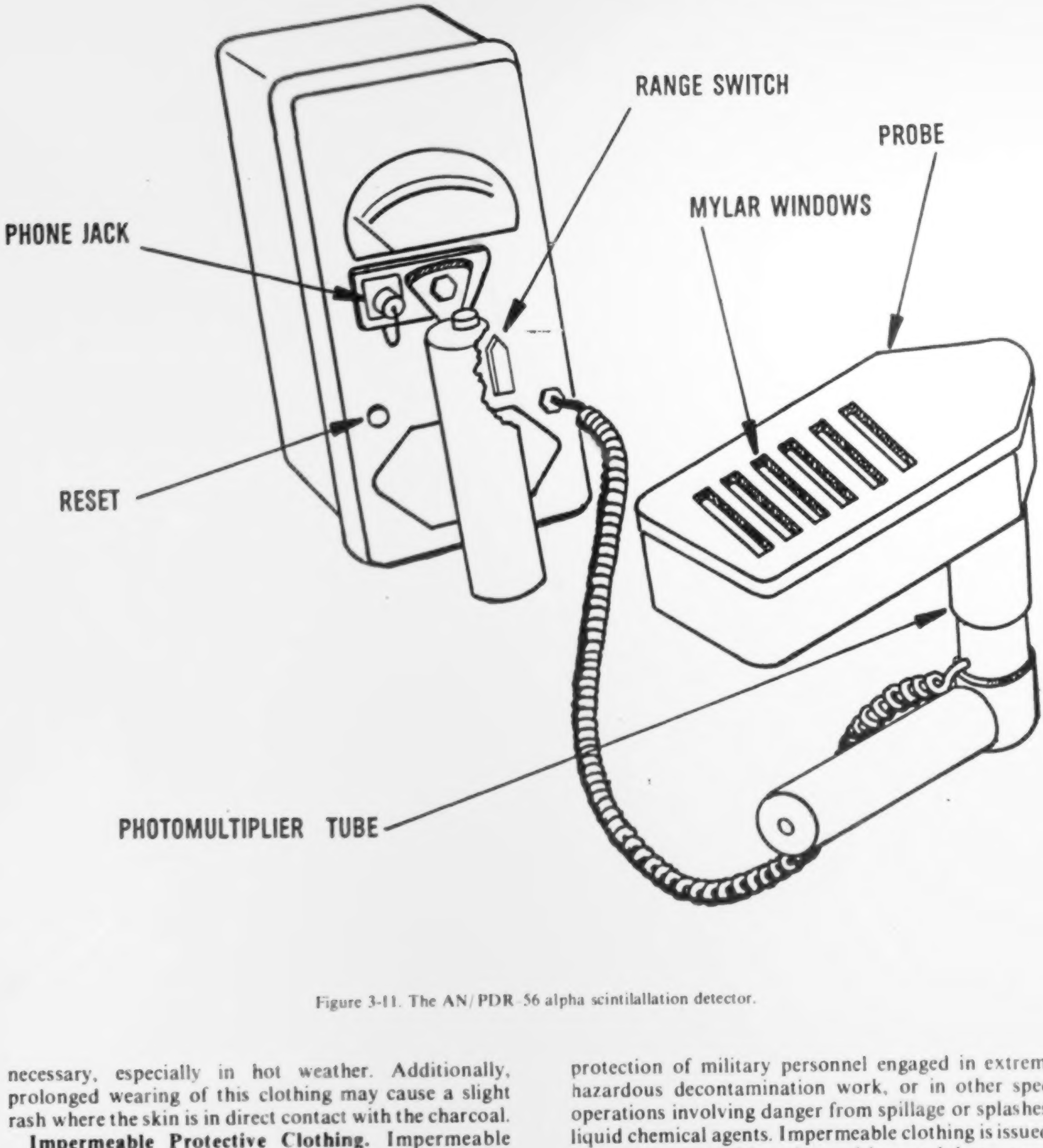


Figure 3-11. The AN/PDR-56 alpha scintilallation detector.

necessary, especially in hot weather. Additionally, prolonged wearing of this clothing may cause a slight rash where the skin is in direct contact with the charcoal.

Impermeable Protective Clothing. Impermeable protective clothing does not allow the passage of air through its fabric. This clothing is made of cloth coated on both sides with butyl rubber. The material is resistant to liquid chemical agents and provides adequate protection against biological agents and raioactive dust. Although resistant to liquid chemical agents, impermeable clothing may be penetrated by them. Liquid contaminants should therefore be neutralized or removed as quickly as possible.

Use. Impermeable clothing is intended primarily for protection of military personnel engaged in extremely hazardous decontamination work, or in other special operations involving danger from spillage or splashes of liquid chemical agents. Impermeable clothing is issued to those who work with toxic munitions and those engaged in decontamination of grossly contaminated areas.

Wearability. Impermeable clothing is sufficiently durable to withstand normal use in decontamination operations. This clothing prevents normal air cooling of the body by passage of air through the garment and the consequent dissipation of body perspiration. Therefore, impermeable clothing will quickly cause discomfort to the wearer during hot weather. In temperatures over 80°F. while performing normal activities, the approximate length of time a person can wear an impermeable suit before becoming overheated and possibly collapsing is 15 minutes. It is important to note that with increased activity and/or increased temperatures this time would be greatly reduced.

Protective Mask. Your M17-series (M17 or M17A1) chemical-biological protective mask (figs. 3-12 and 3-13) is one piece of personal protective equipment that must function perfectly every time. Make sure it's always safe, with daily preventive maintenance (PM) and scheduled weekly services.

Technical Order (TO) 14P4-9-31 discusses the PM steps you should follow for your mask and hood. Daily PM amounts to a quick visual check for grime, damage, and missing or loose parts on the mask and carrier; cleaning; and putting on the mask to test for leaks and operation.

Exercises (810):

1. What are the two types of protective clothing?

2. When should permeable clothing be used?

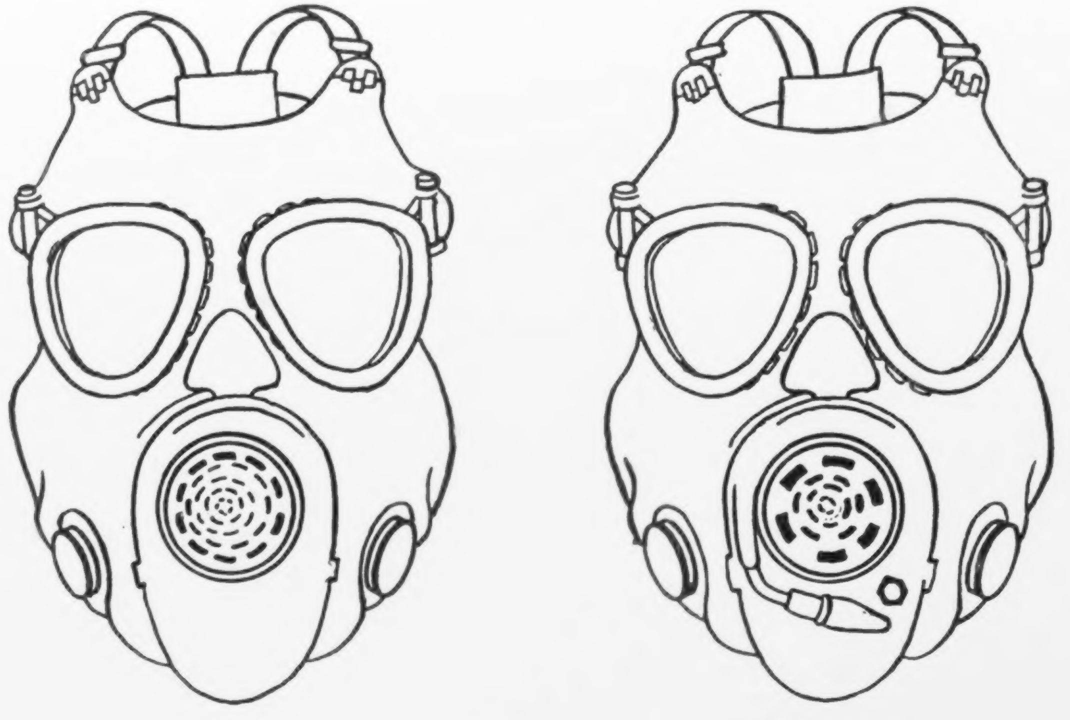
3. When should impregnated clothing NOT be worn?

4. What should you do if a liquid chemical agent is spilled on permeable protective clothing?

5. Impermeable clothing provides protection against which agents?

3-4. Personnel Decontamination

Evacuation of personnel for specialized decontamination will probably be impractical in a fallout situation. Initially, individuals will decontaminate themselves, their clothing, and their equipment, employing the most expedient available methods, such as use of brushes, beating clothing with sticks, and vigorous shaking of clothing (respiratory protection must be worn while this is being done) before entering shelters or uncontaminated structures. Special radiological decontamination of individuals will be performed only when the situation permits or necessitates. Casualties, survey team members, ambulance drivers, litter bearers,



M17

M17A1

Figure 3-12. M-17 series protective masks.

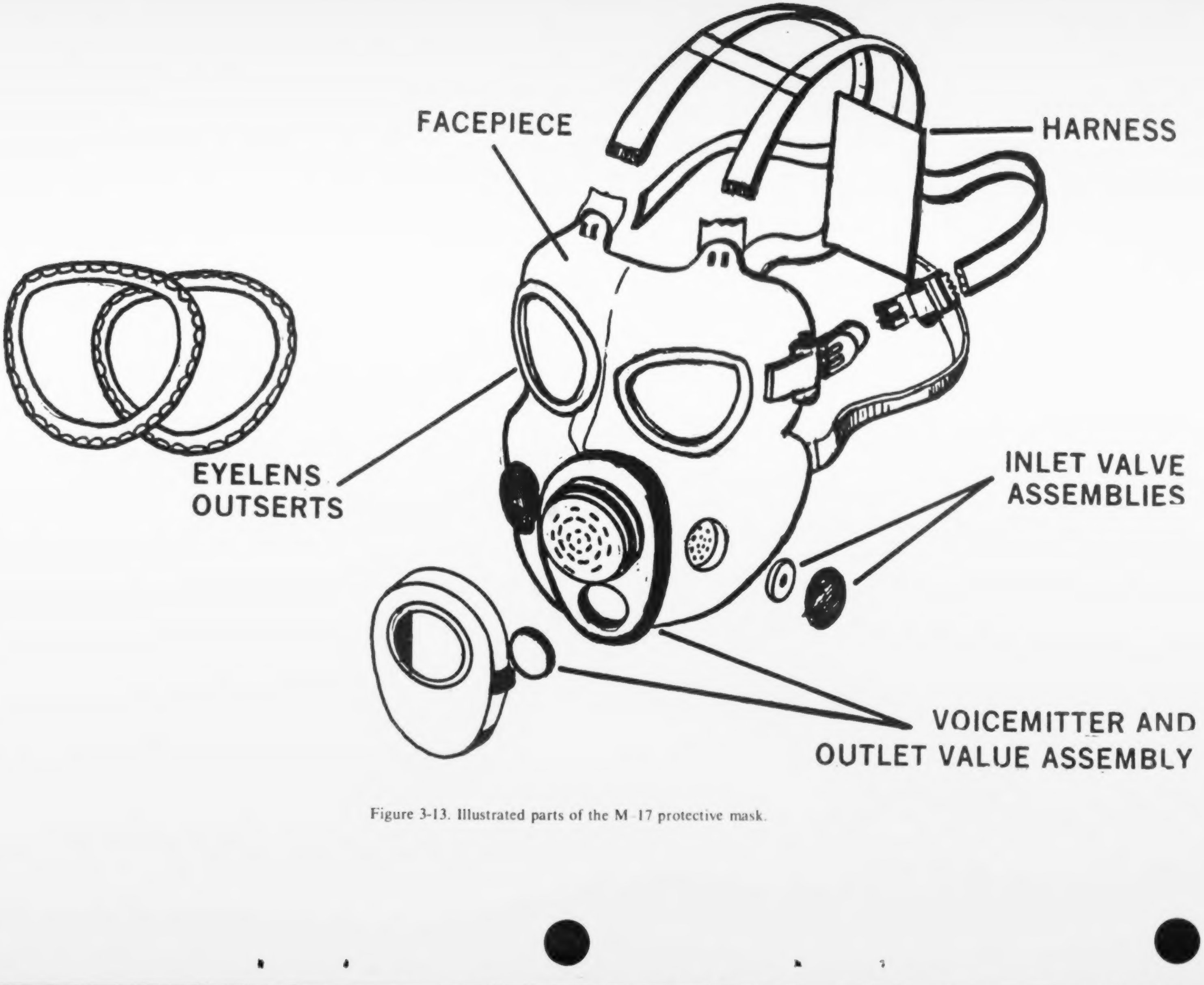


Figure 3-13. Illustrated parts of the M-17 protective mask.

and hospital medical personnel entering the hospital are decontaminated to prevent possible transfer of contaminants.

The complete decontamination of casualties will be accomplished at the decontamination station established immediately outside the hospital emergency entrance. However, ambulance drivers and litter bearers should be instructed and understand that any dirt or rust removed or shaken from the patient's clothing prior to positioning in the ambulance will not help protect the patient but will also decrease the hazard to litter bearers and ambulance drivers. The procedures for decontamination of personnel, equipment, and area will be covered in this section. Remember, no matter what agent the individual has been exposed to, initially the basic decontamination procedure described earlier should be followed.

811. State procedures for decontaminating personnel, equipment, and the area.

Decontamination Procedures. Personnel decontamination is essential to prevent further exposure as well as to protect treatment personnel. At the outset, the goal of personnel decontamination is complete removal of contaminants to achieve zero levels of radiation. If, after repeated attempts, these levels are not attainable, the maximum allowable skin-contamination levels are 660 counts per minute (cpm) using the PAC-1S and 1 mr/hr (milliroentgen per hour) for beta/gamma contamination.

The first effort in personnel decontamination is proper removal of contaminated clothing. Proper sequence in removal minimizes contamination of skin surfaces and ingestion or inhalation of contaminants. Patients' contaminated clothing should be removed in the sequence described in Chapter 1 of this volume for patient decontamination.

Persons who sustain cuts or puncture wounds while working in a contaminated area or with contaminated material must take immediate action to protect the wound and decontaminate it if necessary. The injury should be monitored with the AN/PDR-27, PAC-1S, or AN/PDR-56F. If contaminated, the wound should be flushed with plenty of water. If this does not remove the contamination, scrub the wound with a large amount of soap lather and rinse with water. In the event of severe injury, medical treatment of wounds takes precedence over decontamination.

Intermittent monitoring of hands, face, and clothing will help prevent undue exposure to personnel carrying out decontamination procedures. Unskilled personnel, under the guidance and supervision of trained monitors or delegated personnel, should be utilized for decontamination operations.

Equipment Decontamination. Often it may be practical to move equipment to an isolated site for decontamination. Since most operations require washing, water must be available. Care must be taken that the wash water does not drain into areas where it will still be a hazard. If time permits, pits may be dug in which the contaminated water may be drained and later covered. It is important to keep in mind disposal of the contaminant if the decontamination is to have maximum value. In general, the steps in decontamination of equipment and clothing, listed in order of speed, are brushing, washing, and aging. In some cases, brushing may reduce dry contamination to the permissible level. Washing in most cases will be adequate even if brushing has not been effective. In time aging will reduce the contamination to a negligible amount, with the length of time depending upon the decay rate and the amount of radioactive contaminant. When speed in the decontamination of equipment or clothing is desired, it is advisable to brush first, wash second (if brushing has not been effective), and age third (if washing has not been effective). Where speed is not an important factor, aging is most desirable since it eliminates more laborious decontamination.

Brushing. Ordinary brushing will usually remove a great part of contaminated dust from clothing or small equipment and may often reduce the contamination to or below the permissible level. Clothing or other fabric material should be shaken before being brushed, since, if this is not adequate, it at least will reduce the labor and time necessary for brushing. If thorough brushings do not reduce the radioactive intensity to the desired level, then washing should be attempted. Monitoring will indicate the effectiveness of decontamination. The following precautions are necessary in brushing:

a. Protective masks must be worn.

b. Contaminated items should be brushed or shaken from the upwind side.

c. The equipment and the individual must be monitored at completion of work.

Washing. Any contaminant remaining after brushing usually is reduced below the permissible level by ordinary washing with soap or synthetic laundry detergent in a modern washing machine. Direct contact with contamination should be kept to a minimum, and both the clothing and the machine should be monitored afterwards. When hard water must be used, washing should be done with a synthetic laundry detergent. Soap, when used with hard water, forms an insoluble lime compound in the fabric, and this deposit, which may carry contamination, is very difficult to remove.

Aging. When washing fails, and the item is too valuable to be buried or destroyed, it should be decontaminated by aging. The item should be marked to indicate it is radioactive and then taken to a place for aging that has been designed for that purpose.

Area Decontamination. Area decontamination will probably be required of the medical service only at the ambulance unloading parking area and in and around the temporary or permanent decontamination station. Also, it may be necessary to decontaminate walkways between essential buildings. You may want to refer to table 2-2 for a detailed description of decontamination methods and materials for radiological decontamination.

In most calculations of fallout, it is assumed that the radioactive debris is deposited uniformly and in a layer of one particle in depth over an infinite plane surface. In the real situation, the fallout may be intimately mixed with an inch or more of soil buried in the surface irregularities, or mixed with other nonradioactive debris.

Personnel Decontamination Stations. Some of the important things you should remember when planning a personnel decontamination station are location; planned undressing, showering, and monitoring procedure; adequate water for showering facilities; clothing and equipment reissue; disposal of contaminated items of clothing, equipment, and wash water.

Types. There are three types of personnel decontamination stations: permanent, semipermanent, and improvised or temporary.

Permanent decontamination stations. Permanent medical decontamination stations generally will be elaborately constructed and will be built only in conjunction with or adjacent to permanent hospitals which are considered potential shelters in event of NBC attack. They will be resistant to or impermeable to all NBC contaminants and generally designed to withstand the effects of high explosives and nuclear bombing.

Permanent decontamination facilities may be constructed in conjunction with or adjacent to latrines. They may be located at entrances to shelters or at the entrances to hospitals which will be used as protective shelters and treatment centers in event of NBC attack. This could well be used as storage space when it is not functioning as a decontamination facility.

Semipermanent decontamination stations. Semipermanent stations may be either fixed (having permanently installed pipes, latrines, etc.) or mobile. Mobile units will use tenting or other prefabricated wall structures, flexible piping which can be readily assembled; chemical or pit latrines; permanent or temporary water supply, such as large water tank trucks; and will have the same type portable table, cot, chair, first aid, and medical equipment as is kept in the standard 36-bed portable dispensary. Air filter and power supply units will also have to be of a portable variety.

Temporary or improvised decontamination stations. Temporary stations will be established only as deemed necessary by the DBMS or the Environmental Health team. They may be established and used by personnel and patients coming from a contaminated area to an area where the external environment does not contain any type of contamination. Commanders may wish to establish temporary stations on the fringe of areas that have been attacked, where patients and hospital personnel are delivered to an evacuation point for return to the permanent medical facility.

Certain requirements must be fulfilled and facilities made available for a temporary station. These include water for bathing, convenience to a main route of communication, on the upwind side of any contaminated areas, and provision for some degree of cover. They may be established in the open, or they may use a combination of open areas and tents or temporary buildings. Roped-off areas where people can remove contaminated clothing, shower, be monitored, and redress must be provided. Each area must be supervised by attendants. Containers, pits, or some special arrangements must be made for disposal of contaminated clothing and equipment for replacement with clean items. Attendants must wear full protective clothing and masks. Several types of shower facilities may be used. Water trucks, power-driven decontaminating apparatus, Lyster bags, standard 3-gallon decontaminator, etc., may be used.

Decontamination station planning factors. In planning a decontamination station you must consider the location of the facility in relationship to other important facilities (i.e., hospital, fallout station, etc.), patient decontamination requirements, direction of movement through the decontamination station, and management of litter casualties.

Location. Essentially, the location of the decontamination facility must be considered in its functional relation to the location of the hospital command post, emergency disensary or hospital, fallout shelters, and buildings that will be used for occupancy during NBC attacks. When only shelter protection against radioactive fallout is considered, the most practical and inexpensive decontamination facility may be constructed or located in or adjacent to the latrines. Where removal of radioactive dust particles only is concerned, disposal and replenishment should be provided only for outer clothing and contaminated masks and hoods. The facility should be located in or near buildings that will be used as treatment centers or hospitals. The temporary facility should be located so that it will be relatively safe from contamination by primary or secondary aerosols. A minimum isolation distance of 2 miles is recommended. Where there are prevailing winds, the facility should be upwind from the contaminated area, but not on a slope or in a location where contaminants will easily reach to the surface and drain into surface waters. It is desirable to keep washing and clean areas upwind from the unclean area. These areas should be at least 50 to 100 feet apart.

Movement through the decontamination station. When the ambulance and medical personnel are sent out to the contaminated area to pick up casualties, the same procedures of handling and managing the patient as discussed earlier in Chapter (1) of this volume should be followed. In the process of moving through the decontamination station, regardless of type, the patient progresses from a contaminated area to a less contaminated or uncontaminated area. The control of the spread of radiological, biological, or chemical contaminants should be as exacting a procedure as is sterilization of surgical equipment and sterile technique. Outside of the entrance of the station, brooms, brushes, and water sprays are provided for removing contaminated earth, dust particles, chemicals, and other particles that may be adhering to the clothing. On entering the station, all outer equipment is removed, then the clothing is removed in this order—hat, cap, or hood (mask remains on), outer jacket or shirt, trousers or skirt, then shoes, and finally just before going through the door to the shower room, the underclothes, socks, and mask. As clothing is removed, it is placed in the contaminated clothing chutes or in the receptacles provided. After showering with soap several times (paying particular attention to head and all hairy parts of the body) and drying, personnel go into the dressing room where patient pajamas or clean fatigues are issued. After dressing, they proceed into the hospital or shelter.

Exercises (811):

1. Describe how personnel are decontaminated?

2. Most equipment can be decontaminated by using which method?

3. What are the steps in decontaminating equipment (in order of speed)?

4. What precautions should be taken when brushing equipment?

5. When is "aging" used for decontamination of equipment?

6. What are the three types of personnel decontamination stations?

7. With all of the three types of decontamination stations, what is an important consideration?

8. How should patients move through a decontamination station?

3-5. Radiological Detection/Decontamination of Food Supplies

Following a nuclear attack, widespread contamination on the nation's food supplies could occur. The problem will consist not only of thermal and blast damage of food stocks and neutron-induced activity from close-in detonations, but also fallout contamination of unprotected food and water which can occur hundreds of miles from the point of detonation. Preventing internal radiation exposure from ingested fission products in contaminated food is of primary concern.

Immediately following heavy fallout, all personnel should refrain from consuming food that are in any way suspected of contamination or have not been protected from direct fallout. All such foods must be monitored and approved by the environmental health team before consumption. Nuclear agents and their potential for devastation are well recognized. Whether in times of peace or war, you must be knowledgeable of the effects of agents on food, food animals, and on meat products. You must also quickly recognize the proper decontamination practice to render a food fit for human consumption.

812. State the effects of nuclear warfare on food and the appropriate decontamination procedure to produce a food fit for human consumption.

Blast damage. Fresh food products, such as potatoes, apples, and onions, packaged in the usual light wooden boxes, will be bruised and crushed. As a result of this mechanical damage, decay during subsequent storage is higher. Thus, food not rendered completely unusable should be used during the early period to prevent loss. There will be few, if any, failures of glass or metal containers due to the high overpressures, on the order of 45 psi, although some will be pierced by sharp missiles such as flying glass.

The blast damage to packaged foods results mainly from dislodgement from storage shelves and subsequent breakage of glass containers. Containers made of soft materials, such as paper, polyethylene, or cardboard, may suffer severe damage from flying debris. Splintered glass may cause serious contamination of these food products. Puncture of containers also renders these foods vulnerable to spoilage microorganisms. Damage to cans or jars stored in basements is negligible, even when the main structure of the building is demolished. Mechanical crushing and perforation damage can be minimized by basement storage. Maximum blast protection will also be afforded by permanent-type food storage facilities such as commissary cold storage warehouses. In any case, the food storage area should be out of direct line with windows and doors. Foods stored in basements or otherwise protected from blast effects such as in reinforced steel and concrete buildings like commissary cold storage warehouses will be protected against thermal effects.

Meats and meat animals located within a short distance from the blast site will probably be completely destroyed by heat and pressure. However, as you move away from the blast site you will find foods with only secondary damage from the blast. Common sense is your best tool in determining the edibility of this meat (trimming of the affected areas may be all that is necessary). Remember, all meats may be contaminated with radiation-bearing dust; therefore, all food must be monitored with appropriate equipment before being prepared.

Blast damage in the form of high blast overpressure and high winds may damage meat tissues. These effects increase the rate of deterioration of the meats. You should examine the meats carefully for this damage. If damaged meats are found, they should be used immediately after careful monitoring and trimming. Remember that there may not be a supply of meat animals, thus necessitating the utilization of all stored meats for a long period of time.

Secondary effects of blast, such as disruption of refrigeration, can result in loss in perishable foods such as chilled or frozen meats (which will spoil if not refrigerated) if alternate sources of power supply are not available. Despite lack of refrigeration, frozen foods may be held for several days before thawing occurs, which would necessitate issue. Under conditions of sustained power loss, highly perishable foods such as fresh chilled milk, chilled meats, etc., should have issue priority. It is important that you, the inspector, examine meats carefully for spoilage, recommend destruction of inedible meats, and assist in relocating meats to a more suitable location for storage.

Radiation Contamination. The passage of radiation fission products through the food chains (fig. 3-14) and into our food is an important concern. Additionally, radioactive fallout may contaminate existing food sources.

Food chain transfer. Hazards to livestock and subsequently to man, who depends upon livestock as a source of food, are of two types. One is the external hazard from the gamma-emitting fallout particle, and the second is the internal hazard resulting from the contaminated food, air, and water ingested by livestock and man. For example, animals grazing on contaminated pasture or consuming contaminated feed and water may ingest some 200 different radioactive isotopes that are found in fallout particles. The two primary fission products of concern we will talk about are iodine-131 and strontium-90.

Iodine 131. The main pathway in which iodine-131 reaches the human is through fresh fluid milk. Dairy animal's grazing pasture and feeds contaminated with fresh fallout secrete significant quantities of iodine-131 (5 to 10 percent of the amount ingested) in milk. Internal exposure to the human occurs due to the rapid and selective deposition of this fission product in the thyroid after consuming fresh milk from dairy animals.

Maximum concentrations in milk may be reached within two to four days after a single deposition of fallout on pasturage. Iodine-131 abundance then decreases by 50 percent about every 5 days due to the combined effects of radioactive decay and weathering losses from the contaminated vegetation. Present milk processing and marketing practices result in milk usually being delivered to the consumer within 2 or 4 days, thus allowing little time for radioactive decay before the milk is consumed.

Under certain circumstances, this fission product may constitute a potential radiation hazard during the first two months following a nuclear attack. The uptake of iodine-131 in the thyroid of children and adults is approximately the same. Thus a given intake of iodine-131 would result in a 10 times larger dose to the thyroid of a 1-year-old child than to an adult. Children treated in infancy with x ray in the neck region for enlarged thymus or for other benign conditions in that region have shown a significantly high incidence of tumors including thyroid carcinoma than children in control groups.

Due to this finding as well as due to the possible increased radiosensitivity of developing tissue (i.e., larger number of mitoses), the critical segment of the population is felt to be young children approximately one

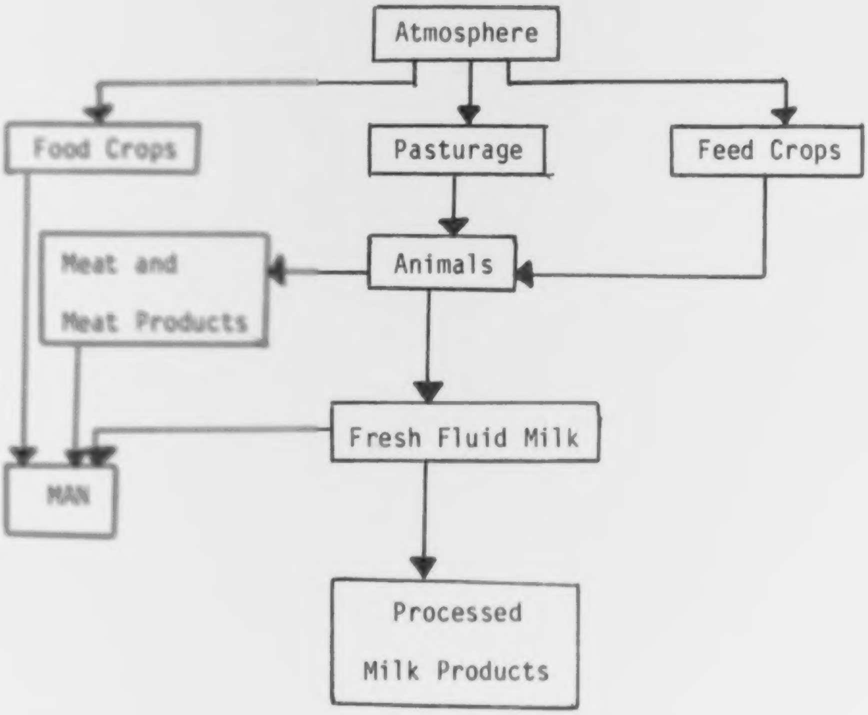


Figure 3-14. Important steps in the transmission of radioactive material through the food chain to man.

year of age. Pregnant women may also be included due to the transfer of iodine across the placental barrier and the increased sensitivity of the fetal thyroid for radioiodine.

Post-attack countermeasures for prevention of iodine in the food chain would include:

a. Elimination of milk from people's diet. On a short term basis, milk can be eliminated from the diet with little difficulty, except from the standpoint of infants and children. Major problems would be encountered if milk was eliminated on a long term basis, since milk constitutes a major source of calcium and protein in the diet.

b. Removal of iodine-131 from milk. Research indicates that ion exchange resins can be used to effectively reduce iodine-131 from milk during critical periods. It will, however, be some time before the technical capability exists to provide treated milk for more than a small number of consumers.

c. Use of stored foods. Use of stored cattle feeds is an effective countermeasure when such feed is available and adequate warning is received in time to implement necessary changes in the feeding practice. Unfortunately, sources of stored feeds capable of supporting large numbers of dairy cattle is not always available. Past experience has shown that without advanced warning, cows may consume large amounts of contaminated forage before control measures can be initiated. Following such an incident, the feeding of uncontaminated feed will limit the duration of the temporary appearance of significant levels of iodine-131 in the milk.

d. Use of stored milk and marketing procedures. Delay marketing to allow radioactive decay. Due to decay alone, iodine-131 is reduced by one-half every 8 days. If contamination is light, storage of milk for 8 days may be adequate.

Freeze package milk and store for 30 to 60 days if contamination is high. If all milk sources are critical, consider diluting contamination by blending with uncontaminated milk. Do not destroy or dispose of milk contaminated with iodine-131. Processing of fresh milk into longer shelf-life items such as butter, cheese, ice creams, and powdered and canned milk will allow for storage and further reduction of iodine-131 levels.

You should direct some of your efforts towards preventing iodine-131 from being transferred through the food chain. Maximum concentrations of iodine-131 in milk may be reached within 2 to 4 days after a single disposition of fallout on pasturage. Iodine-131 abundance then decreases by 50 percent about every five days due to the combined effects of radioactive decay and weathering losses from the contaminated vegetation. Present milk processing and marketing practices result in milk usually being delivered to the consumer within 2 or 4 days, thus allowing little time for radioactive decay before the milk is consumed. You can prevent the movement of iodine-131 through the food chain by the use of aged cattle feeds, stored milk, and thyroid-blocking agents. These agents limit the absorption of radioactive iodine by the thyroid—e.g., potassium iodide tablets. This preventive measure should only be used where above methods cannot be initiated.

Strontium-90. Consuming fallout contaminated vegetation and drinking milk from dairy cows that have fed on contaminated feed and pasturage are the main pathways through which strontium-90 reaches the human body. Although strontium is similar to calcium, it is not identical biochemically. The body has a natural preference of calcium over strontium. However, if calcium levels in the body are too low, then the body will absorb the stronium-90. Minute levels of the stronium-90 present a serious internal hazard.

If no signs of radiation sickness (diarrhea, unsteady gait, or internal hemorrhage) appear following exposure to nuclear blast or fallout, you can decontaminate animals by scrubbing with soap and water. You must do this as soon as practical after exposure. Animals thus exposed and decontaminated can then be slaughtered, and their muscle tissue is safe to consume. However, care should be taken to discard all internal organs because of the possibility of damage from ingested radioactive particles. Remember, strontium-90 has been found to replace calcium in the body when ingested. Because of the possible presence of strontium-90, fresh animal byproduct with a high content of calcium (such as milk and other dairy products) should not be consumed following a nuclear blast.

Therefore, livestock first must be provided shelter during and after fallout to protect them from the external radiation hazards from gamma rays. Shelter provided by a barn will give some protection from this hazard. A shelter will also help protect feed and water from fallout contamination. The important objective is to try to prevent the radioactive material (fallout) from becoming incorporated or mixed with the feed and water and thus prevent ingestion of harmful quantities of radioactive material.

Radioactive fallout. Alpha is a potential hazard only when taken into the body by inhalation or ingestion with contaminated food and water, the latter not being likely. Alpha will not constitute a problem under wartime conditions. Beta and gamma radiations emitted during decay of fission products are of principal concern from the standpoint of food and water contamination. Fission products can gain entry into the body by consuming food and water contaminated with fallout. This is the principal route of internal radiation exposure.

The contamination of food supplies can be prevented by storage in dust-tight facilities. Packaged food items in original packing material will be completely safe for consumption if the package is still intact. Unprotected foods may have surface contamination in appreciable amounts. We will now look at how to decontaminate packaged food and vegetables, and meats.

Packaged food and vegetables. Food in cans or other types of sealed containers are in no danger from radiological contamination. Any radioactive contamination will affect only the outer surface of the container, and this can be decontaminated by washing and scrubbing. Very active containers in many instances will contain food that is entirely safe. Care should be taken not to accidentally transfer fallout particles to exposed food surfaces when packaging material is removed. Under no conditions should cans or other sealed containers be open until they have been monitored and decontaminated if necessary. Food not protected in sealed containers must be suspected and then disposed of or isolated if it cannot be decontaminated. Such foods as potatoes and other hard-skinned vegetables and fruits can be decontaminated by peeling, scraping, washing, or scrubbing. Prepared foods in open containers will most likely be contaminated. Remove the outer leaves of the lettuce or cabbage, then wash. Unpackaged food that has been exposed in a contaminated area may not be worth decontaminating. A general rule is that all unpackaged foods that have been exposed to contamination should be destroyed. Boiling or cooking of the food will not eliminate the radioactivity. In an emergency situation food exposed to contamination may have to be consumed but only if the readings of a RADIAC meter are insignificant.

Meats. Fallout contamination of meats is the main effect from the nuclear blast. Meats protected from dust, such as those in cans, boxes, and inside cold storage plants, may be free of radioactive fallout; however, all food must be monitored before being issued as an edible food. When meat items are found to be contaminated with radioactive fallout, the following decontamination steps may be accomplished.

a. Canned meats—wash containers thoroughly and remonitor.

b. Carcass beef—trim away contaminated fat (outer 1/4 to 1 inch) and remonitor. Prevent contamination during transfer from storage to dining halls.

c. Boxed or wrapped meats--clean off all dust carefully, open, and monitor the product; if it is not contaminated remove it to a noncontaminated area.

Disposition of Contaminated Foods. Food wastage will be one of the major problems faced in the event of nuclear war due primarily to lack of public education. No food should be abandoned as unfit for use. Here are some alternatives to throwing all of the food away:

a. Set aside to allow radioactive decay.

b. Use highly perishable foods first, canned and packaged foods later.

c. If emergency situation demands, blend food with uncontaminated material to reduce radioactivity.

d. Use food rationing.

Exercises (812):

1. How would food in cans (or other sealed containers) be affected in a nuclear attack and how should it be handled?
2. How can potatoes and other hard-skinned vegetables and fruits be decontaminated?
3. What are the effects of a nuclear blast on meats, meat animals, and poultry? How are they decontaminated?
4. Why are we concerned about strontium-90 contamination of fresh animal byproducts?
5. What is your *best* tool to use in determining the edibility of exposed meat and how may an edible product be produced?
6. Describe the decontamination steps for canned meats, carcass beef, and boxed or wrapped meats.

CHAPTER 4

Biological Warfare

ALTHOUGH biological warfare (BW) agents have never been used as a significant weapon of war, there is factual evidence that they have been used in some form since early times. In the middle ages war parties dropped plague-ridden corpses into wells of their enemy. This type of warfare was practiced particularly in desert warfare where wells were of strategic importance and easily contaminated. During the French and Indian War in 1763, the British infected the Indians with smallpox by giving them blankets and handkerchiefs taken from infected patients. Approximately 95 percent of the Indians who were exposed died of the disease. In World War II, German agents inoculated canned foods, shipped from the United States to the Allies with disease producing biological agents; the Germans also used such agents against the Rumanian and French Cavalries in World War I. In 1940, claims were made by the Chinese that Japanese planes had dropped plague-infested fleas wrapped in little cotton bags containing grain. It was assumed that their purpose was to initiate an epidemic of plague by utilizing their natural vectors. In the past, widespread natural disease epidemics have decimated the population of various areas and, in most wars, infections and diseases have caused more casualties than have weapons. In a BW attack, you would most likely be involved in recovering and maintaining adequate, safe food supplies, and quarantine operations. In addition, protection of personnel and animals against the effects of biological agents is a prime consideration.

4-1. Medical Aspects of Biological Warfare Weapons

Any small nation having modern and adequate research facilities could produce BW agents on a small scale. The cost of the development of large-scale BW would be much less than some other weapons of war. It is also possible that new and effective methods for artificial dissemination of disease-producing agents may be developed. For these reasons, BW must be assumed to present a potentially dangerous form of attack. Some basic knowledge of the principles of biology and the properties of biological agents is essential for the appreciation of their military significance, so that preparations can be made to render BW attacks, should they occur, as ineffective as possible.

813. Cite methods of delivery of biological agents and the effect of such agents on a population.

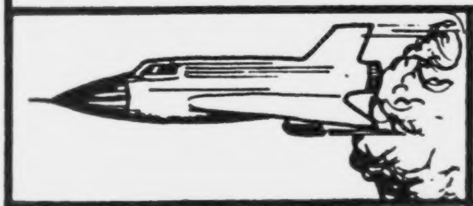
Methods of Delivery. The primary object of BW attack is people. The attack is either direct or indirect through limitation of the food supply or, in some instances, by destruction of domestic animal transportation. BW is antipersonnel warfare, but not antimaterial warfare, in that housing, buildings, factories, and other structures remain intact and can be made useful in a short time. BW agents may be released from mortar and artillery shells, bombs, airplane spray, missiles, or various methods of sabotage (fig. 4-1). They may appear in the form of powder, vapor, aerosol, liquid, or liquid droplets having the appearance of rain or dew. They may have little or no color and may be odorless. Most of the methods of releasing BW agents can also be used for toxic chemicals. In addition, living organisms called vectors can be used in biological operations. These vectors include flies, mosquitos, fleas, ticks, and lice. Animal hosts of many of these vectors may also be employed. These same hosts, however, may hold a clue to the recognition and detection of biological attack.

Small dusting or spraying devices could be used to introduce agent material into the ventilating systems of large office buildings, auditoriums, and theaters with little danger of detection. Infective microbes and toxins could be pumped directly into the mains of city water supply distribution systems or introduced by use of backsiphonage principles which might be applied even in private homes. Enemy personnel working in food establishments might be in a position to contaminate unprocessed foods, such as milk. Effective measures might also be developed to distribute pathogens on currency, stamps, and envelopes and in cosmetics, shaving soap, chewing gum, candy, and other articles.

Effect on Population. Many rumors and published articles have made sensational claims that biological (germ) warfare could wipe out all forms of life in a community. Often these rumors and articles have been based on misconceptions which have in turn led to misrepresentation and to misunderstanding. There is no known germ or biological agent that can wipe out all forms of life in a community. In order to accomplish these sensational claims, it would be necessary for each individual to be susceptible to the microorganism (germ) or toxin employed to be exposed to an effective amount of the agent. It is obvious that neither of these conditions is likely to exist.

From the earliest time, people have been continually fighting a defensive battle against microorganisms in the form of disease, and have been able to survive through development of immunity, improvement in sanitation and nutrition, and the progress of medical science. The use of microorganisms as BW agents is

PROBABLE ENEMY METHODS OF DELIVERING BIOLOGICAL AGENTS

	AIRCRAFT SPRAY
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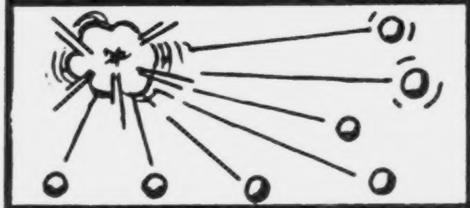
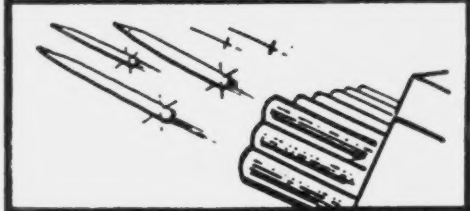
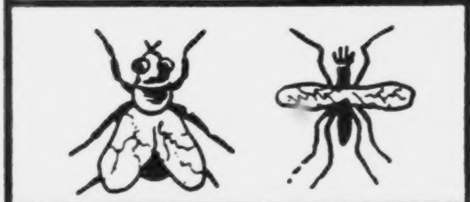
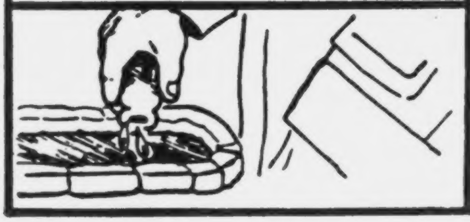
	BOMBLETS FROM MISSILES
	ROCKETS
	VECTORS
	COVERT/SABOTAGE

Figure 4-1. How biological agents may be released in our environment.

simply a military adaptation of naturally occurring biological attacks. The suffering caused by most diseases is not greater than that caused by severe injuries inflicted by shell fragments or machinegun fire; but the changes of complete recovery from infectious diseases are much greater than from injuries caused from other types of warfare.

Because naturally occurring epidemics have caused tremendous havoc to mankind in the past, it has been asserted frequently that artificially induced epidemics could be produced in the future by attack with various biological agents. However, since epidemics tend to spread slowly, they probably can be effectively controlled or prevented by modern sanitation, hygiene, quarantine, immunization, or treatment measures; hence, widespread explosive epidemics are not expected to result from BW attacks against highly civilized populations unless there has been severe disruption of medical and sanitary facilities.

Exercises (813):

1. How may biological agents be released into the environment?

2. What are some types of vectors which may be used in biological warfare?

3. What is the effect of biological warfare on a population?

4-2. Biological Agent Detection

Biological agents can definitely affect our forces' ability to continue fighting. Therefore, we must be able to detect and identify these agents so that we can protect ourselves and others.

814. State characteristics of biological agents and how they may be detected.

Characteristics of BW Agents. Most of the BW agents, particularly the pathogenic microorganisms and toxins, have certain properties not possessed in general by other weapons. They have a delayed action in that an incubation period, often of days, must elapse from the time the victim is exposed to an infectious agent until the development of clinical signs. Identification of agents is difficult and slow since their presence cannot be detected by the unaided senses. It takes hours, usually days, for agents to develop in an artificial medium or in animals and for necessary tests of the suspected material to be made. The microorganisms are living agents in contrast to other agents of warfare. Under favorable conditions pathogenic microorganisms can reproduce and multiply in the host, so that originally small numbers of pathogens may in time constitute a grave risk to health or perhaps to life. Some contagious pathogens spread from individual to individual and cause epidemics. Most are also quite selective, attacking only certain species of animals or plants. While a given weight of biological agent theoretically may be many times more dangerous than an equal amount of the most effective chemical agent, from a practical standpoint, its activity is strictly limited by its ability to overcome the resistance of the target host. Finally, biological agents lend themselves well to covert (hidden) use because the small amounts of material needed are easily concealed, transported, and used in sabotage operations. Because of the relatively small amounts required, their costs should be much less than that of other agents or weapons.

A regional outbreak of a contagious disease which attacks many individuals and spreads rapidly is called an epidemic (epizootic in animals and epiphytotic in plants). In each condition there is an unusual increase in the number of cases of the disease in a limited time among a limited population. Following large-scale dissemination of a biological agent, an initial outbreak of disease of epidemic proportions might occur. This might or might not be followed by a secondary or epidemic spread of the disease, depending upon its relative contagiousness, the presence or absence of favorable environmental conditions, and other factors. Since epidemics among the human population can be prevented or controlled by sanitation, immunization, quarantine, and treatment, rapidly spreading epidemics are not considered to be likely aftermaths of biological attacks in civilized countries as long as these controlling factors remain at a high level of efficiency. Epizootics among animals have more dangerous possibilities than do epidemics among humans. Because of the herding and feeding habits of animals, the control of the disease requires extensive use of costly diagnostic and immunological procedures, quarantine where possible, and often the destruction of large numbers of infected animals.

Biological and chemical warfare agents are similar in many respects. They both are antipersonnel, rather than antimaterial, weapons. They may be dispersed in air and travel with the wind in a similar manner and are capable of contaminating terrain, clothing, equipment, food, and water. Humans, animals, and plants are susceptible to attack by these agents in varying degrees. Unlike projectiles, they can enter any spot where the air can circulate. Various degrees of protection against both of these agents are afforded by protective masks, protective clothing, and collective protection devices. Biological agents have an advantage over environmental conditions, hence smaller and less costly amounts are needed, and sometimes epidemics might be produced. Biological agents have a delayed action of hours or days; some chemical agents act almost immediately and others within a matter of minutes or hours.

Detection. The detection and identification of BW agents require several days or weeks and can be done by trained personnel. Detection and identification cannot be done merely by placing contaminated material under a microscope. Diagnosis must be made from material taken from sick animals, plants, and people, or from observing their symptoms. You cannot see, feel, or taste germs spread in a BW attack. You must depend on "clues" to lead to their detection.

The appearance of certain clues may warn you or cause you to suspect a BW attack. Watch for any of the following items or circumstances:

a. Aircraft dropping unidentifiable material or spraying unknown substances.

b. Unusual shells or bombs, particularly those which burst with little or no blast.

c. Smokes or mists of unknown origin.

d. Unusual substances on the ground or vegetation such as unexplained glass bottles or other breakable containers lying around.

e. Unusual numbers of sick or dead animals.

Epidemiological methods may be used as part of a surveillance system to detect a sudden increase in cases of a particular disease or the sudden appearance of an unusual disease and to determine if the situation is due to natural causes or a biological attack. In order for an epidemiological program to be effective, the infectious disease reporting system must be efficient. Prompt reporting of sickness serves three purposes: first, it allows early treatment of the disease; second, it enables medical personnel to identify the biological agent to which individuals were exposed; and third, it helps to prevent the spread of disease from person to person. Once the disease has been identified, effective medical measures can be taken.

Sampling. Field sampling is the actual collection of organisms from air, water, terrain, or other suspected media. Sampling generally cannot be undertaken as a matter of routine. Therefore, to be practicable, sampling must depend on some means of warning to indicate when and where sampling is warranted. The purpose of collecting samples is twofold. The first and probably the most important is to furnish the medics with the material on which to base their identification. The second is to facilitate the location and marking of the contaminated areas.

To establish the identity of BW it is desirable to collect the sample from the primary cloud. The length of time a cloud will remain on a station depends largely on wind velocity and the length of time the dispersing apparatus is in operation. The ideal location from which to sample:

a. Directly downwind from the point of release.

b. In the open so that trees, buildings, hills, or similar obstacles will not interrupt the path of the cloud.

c. In the case of sprays from aircraft, far enough away from the point of release for the spray to have settled to ground level.

To assure the collection of suitable samples, all teams downwind from the point of release should sample during the passage of the cloud. In the case of munitions, the best samples would be at or near the point of release. The concentration of agent should be highest at that point. Fragments from the munitions, leaves of vegetation, stones, and other debris near the point of release provide excellent samples and should be forwarded to the laboratory.

Exercises (814):

1. State characteristics of BW agents.

2. What determines the effectiveness of biological agents?

3. What clues may alert you of a BW attack?

4. How can epidemics resulting from a BW attack be prevented or controlled?

5. How can BW agents be detected?

4-3. Personal Protection

The personal protective measures against biological agents involve our own natural defenses as well as the wearing of protective equipment.

815. Cite personal protective measures against biological agents.

Body's Natural Defenses. Your best defense against BW is the natural resistance of your own body. The body has been fighting germs since you were born. If your resistance is high, you do not catch cold rapidly; illnesses are often not as severe. The same holds true in BW. Keep yourself in top physical condition. Physical exercise, adequate sleep, and proper diet are a strong defense against BW. A high standard of personal hygiene and sanitation is insurance against the spread of diseases. Immunizations are added defense.

In order to do their dirty work, BW agents must get inside the body. The M-17-series protective mask reduces the danger of inhaling germs. Cuts and sores must be kept bandaged. Be careful of what you put in your mouth. Beware of vectors which may bite you and infect your body with BW agents. There is no first aid for treating illness caused by biological attack. If you become ill, see your doctor as soon as possible.

Protective Measures. The following procedures are tips for survival following suspected or actual BW attack:

a. Report illness promptly.

b. Keep yourself and your living area clean and protect yourself from vectors. Unsanitary conditions could produce a breeding area for arthropods and rodents. The control of insects and rodents may be of increased importance following a biological attack since they may serve as a continuing source of infection. The duty uniform and gloves protect against bites from vectors such as mosquitos and ticks that may carry disease-causing microorganisms. Clothing is kept buttoned and trouser legs are tucked into the boots. Covering the skin reduces the possibility of the agent entering the body through cuts and scratches and also prevents disease-carrying insects from reaching the skin. Insect repellents and insecticides are effective against most disease-carrying insects. High standards of sanitation also improve the protection against some vectors.

c. Don't neglect preventive medicine. Take all prescribed medications and immunizations.

d. Keep your nose, mouth, and skin covered. When BW agents are suspected, use your mask and other protective clothing or two layers of ordinary clothing to keep them out of your body.

e. Protect your food and water. Bottled or canned foods are safe after a BW attack if the seals are not broken. Unprotected food may be contaminated. If in doubt, boiling for 10 minutes should kill most of the germs.

f. Keep alert to any signs of BW attack. Watch for clues.

g. Watch out for BW boobytraps. Avoid tempting items of food or drink.

h. Protect yourself from aerosols. The protective mask gives complete protection against aerosols of biological agents. It is not likely that biological agents will settle out from aerosols in any meaningful quantity and remain alive in soil or on vegetation long enough to be a major problem. Where a biological munition is specially designed for ground contamination, however, marching troops may stir up contaminated dust, thus creating a secondary aerosol for some types of "dry" biological agents. These secondary aerosols will present a hazard to personnel in the immediate area but are not considered a hazard of military significance. In areas suspected of being contaminated, individuals should wear the protective mask and hood and decontaminate the cothing that was worn while in these areas.

Exercises (815):

1. What is your *best* defense against biological agents?

2. How can biological agents get into the body?

3. Cite four precautionary measures that should be followed for survival after a biological attack.

4-4 Personnel Decontamination

The objective of decontamination in biological warfare is to render individuals, materials, and areas safe after exposure to biological agents.

816. Describe methods for decontamination of personnel and materials.

Effectiveness of Decontamination. Biological decontamination is the process of destroying the biological agents (killing bacteria and virus, or inactivating toxins) or, should this be impracticable, preventing them from reaching personnel. A material employed to destroy biological agents must be effective against a wide range of organisms, rapid in action, nonhazardous to personnel applying it, and available in quantity, at a reasonable price, in wartime. If such material is toxic, there should be means of inactivating its residues. Many materials have been tested and found to be effective decontaminants, but none is universally applicable.

Decontamination and disinfection are measures which may become necessary after an attack with biological agents. Defensive measures will serve no purpose unless a sufficiently effective warning system is available. According to preent philosophy the main reason for carrying out such procedures would be to diminish the danger of secondary aerosols. Such aerosols may, under some conditions, be created from clothing, equipment, etc. Microorganisms deposited on surfaces may also cause other potential hazards, particularly those of food and water contamination.

This topic is the subject of deep disagreement within North Atlantic Treaty Organization (NATO). The whole concept has been challenged. It remains uncertain whether there is any real need for disinfection procedures after an attack with biological aerosols. This is mainly due to the low deposition of particles small enough to drift over a long distance and due to the rapid natural decay of biological material caused by ultraviolet radiation present even in diffused sunlight. Research shows approximately 99 percent of the organisms pathogenic to man may be killed by the sun.

Principles of Decontamination. The general principles applicable to decontamination and disinfection in the context of defense against biological agent attack are those fundamental to general hygiene.

Heat. Most vegetative bacteria, viruses, parasites, and fungi are killed by boiling (100°Celsius) for a period of 15 minutes. In the case of bacterial spores and certain toxins (for example, staphylococcus enterotoxin) a boiling time of several hours is necessary. In a situation in which the biological agent had not been identified, disinfection by boiling would thus be problematical unless it could be continued for several hours. Autoclaving would be an alternative; however, many materials cannot withstand this process.

Fluid disinfectants. These are mostly solutions of germicidal substances, and a great variety of such disinfectants may be of value, the choice in each case depending upon the situation (halogen compounds such as hypochlorite or iodine preparations, quaternary ammonium compounds, acids such as acetic acid, etc.).

Gaseous disinfectants. A number of substances are available, the most useful being such as ethylene oxide, formaldehyde, and paraformaldehyde.

Disinfection by filtration. The main interest in filtration procedures would be in connection with the sterilization of drinking water. Filtration units for delivering potable water are in common military use.

Personal Hygiene. Washing with soap and water is the most effective, simple, personal hygiene measure for the control of communicable diseases. All persons suspected of being contaminated by a biological attack should, if practical, take appropriate measures to ensure that skin, hair, nails, and clothing are kept free of disease-producing organisms. Disinfection of clothing could be done according to everyday methods such as boiling, soaking in chlorine solution, or both, provided the fabric could withstand such treatment.

Material Decontamination. It is highly questionable whether decontamination of equipment, buildings, etc., is at present a realistic possibility. If it should, however, be judged desirable, the best methods in most cases would be gaseous disinfection with formaldehyde, or simply washing with water, finally with the addition of a fluid disinfectant.

Exercises (816):

1. What effect does ultraviolet radiation (from sunlight) have on BW agents?

2. Most bacteria, viruses, and parasites will be killed after boiling for at least what length of time?

3. Water containing spores or certain toxins requires boiling for how long to be safe to drink?

4. What are three other methods of decontamination and disinfection?

5. What is the most effective personal hygiene measure for protection against BW agents?

6. What is the best way to decontaminate equipment?

4-5 Biological Agent Detection/Decontamination of Food Supplies

It is your responsibility to identify contaminated food items and to decontaminate them, if possible, to provide food for human consumption. Some foods can be decontaminated by destroying or neutralizing the biological agent. The method of decontamination will be largely dependent upon the biological agent involved. The advice of the medical officer should be sought before any attempt is made to decontaminate food suspected of BW contamination.

817. Describe methods for decontamination of food and water.

Food. If biological agents have been used, contamination of all foods not tightly sealed must be suspected. The use of heat is the most practicable means of decontaminating contaminated food. Thorough cooking will reduce contamination to a safe level so that food can be consumed. Decontaminated food must not be consumed until it is pronounced safe by a designated medical officer. Food items may be decontaminated by one of the methods that follows. The type and kind of food as well as the amount of contamination will determine which procedure should be used. Care should be exercised to ensure that the heat completely penetrates the food for the period of time indicated.

(1) Cooking items in a pressure-type cooker (autoclave) at 15 pounds pressure at 250°F. (121°C.) for 15 minutes.

(2) Baking some contaminated items such as bread or related items (in preparatory stage) for 40 minutes at 400°F.; baking meat at 325°F. for about 2 hours.

(3) Boiling certain items for at least 15 minutes is an expedient method when no other method is available.

Food stored in containers resistant to the passage of biological agents (refrigerators, cans, and bottles, etc.) requires only that proper exterior decontamination be performed and that precautions in opening the containers be exercised to ensure that the contents are not contaminated. Sealed containers made of metal, plastic, glass, or porcelain can be immersed for 5 minutes in hypochlorite solution containing about 2.0 percent available chlorine. Addition of 1 part of household bleach (5 to 7 percent available chlorine) to 1 part water gives approximately a 2 to 3 percent concentration of chlorine. As an expedient method, contamination may be reduced to a safe level by soaking the containers for a minimum of 15 minutes in boiling, soapy water, followed by rinsing. The hands must be free of contamination during opening operations.

Food packages that will not stand immersion should be wiped off with hypochlorite solution and the food cooked before eating.

The exterior surfaces of stacks of food packed in impermeable packages can be sterilized by vapor disinfectants such as formaldehyde, ethylene oxide mixtures (ETO), or methyl bromide. Refrigerated food-transporting vans can be used as sterilization chambers. Semitrailer vans are satisfactory chambers in which to sterilize packaged food with formaldehyde vapors, but ETO and methyl bromide are too penetrating to be used in the ordinary semitrailer van.

Foods stored in sacks or other permeable containers also can be decontaminated with methyl bromide or ETO, but because of the limited availability of these materials, it is probable that reliance must be placed on cooking before consumption.

Foods that can be peeled or pared may be decontaminated by soaking in 0.2 percent hypochlorite solution for 30 minutes. After decontamination, the food is then peeled or pared, washed with potable water, and, if appropriate, cooked before eating. This method has been applied satisfactorily to apples, potatoes, and eggs.

All unprotected meats are of special concern to the environmental health technician, since many meat items are ideal environments for bacterial growth because of their high moisture and protein content and their neutral pH condition.

Water. Detecting and analyzing contamination in water are responsibilities of the medical department. The BW decontamination of water is not difficult when regular water treatment facilities exist. However, more chlorine probably will need to be added than during the ordinary processing of the water. If no water treatment facilities are available, water can be decontaminated by boiling for 20 minutes, by distillation if equipment is available, or by using iodine tablets (at least two tablets per canteen of water with 30 minutes contact time) coupled with boiling. A medical officer should pass on the method and the completeness of the decontamination process before any water is used for drinking purposes. Water that has been decontaminated must, of course, be protected against further contamination.

A supply of water purification tablets should be available for emergency situations. Household bleach or hypochlorite supplies available at laundries, bottling plants, dairies, swimming pools, etc., may be used for disinfection if other materials are not available.

Identification of Biological Agents. Laboratory identification of the organisms can be made by swab tests. The preparation of cultures, examination, and identification of the organisms usually constitute a difficult process which consumes many hours or days. Trained technical personnel are required.

Exercises (817):

1. What is the most practical means of decontaminating contaminated foods?
2. When can decontaminated food be consumed by personnel?
3. How safe should food stored in refrigerators, cans, and bottles be considered after a BW attack?
4. Why is unprotected meat of a special concern after a BW attack?
5. How should water be decontaminated if it can't be boiled?
6. How are biological agents identified?

Chemical Warfare

THE KEY to protection from the effects of chemical weapons lies in a knowledge of the pecularities of the various agents involved. You already know the basic background. The problem now is to relate this background to new applications.

Toxic chemicals are present in everyday industrial operations. Those used in chemical warfare (CW) are similar in many respects to those with which you are already familiar. The difference is the strength of the agent, the large area of coverage, and the fact that you are a target rather than a casual bystander.

5-1. Medical Aspects of Chemical Weapons

Chemical agents attack the body and produce specific damage according to the kind of agent used.

818. State the types of biological effects of chemical agents.

Types of Chemical Agents. You should know how each of these agents affects your body. The following is a simple breakdown of the major groups of chemical agents.

a. Choking agents.
b. Blood agents.
c. Blister agents.
d. Nerve agents.
e. Incapacitating agents.
f. Vomiting agents.
g. Tear agents.

Choking agents. The choking agents were among the first chemicals used in WWI. Upon contact with moisture in the lungs, they convert to various acid compounds, decreasing the permeability of the lung tissue. This is followed by inter and intracellular fluids filling the lungs. These compounds are, or were developed from, dye fixitives use in the textile industry.

The early signs and symptoms of exposure to choking agents are generally limited to eye, nose, and throat irritation, with tears and coughing. If the exposure is light and terminated quickly, these symptoms will subside in 15 to 30 minutes. However, if the exposure is severe, prolonged or repeated, within 2 to 24 hours the individual will develop a pulmonary edema (lungs filling with fluid), which even if properly managed, may lead to death.

Blood agents. Misnamed because of an outward manifestation, the blood agents were not effective in WWI. The delivery systems of the day could not place enough cyanide in an area rapidly enough to derive the desired effect. Modern weapon systems can now do this. The cyanides have been used in metalurgy for centuries and in the acrylic and plastics industry since their beginnings. Cyanide inhibits the cytochrome oxidase enzyme system, thereby stopping tissue respiration.

Signs and symptoms are very rapid in onset, and death can occur in field concentrations in 1 to 2 minutes. Headache, dizziness, confusion, labored and violent breathing, dilated pupils, and protruding eyes are early indications. These are followed by reddening of the skin, praticularly of the fingernail beds, violent convulsions, paralysis, coma, with respiratory arrest preceding death.

Blister agents. Blister agents in either liquid or vapor form are readily absorbed by both external and internal parts of the body. These agents cause inflammation, blisters, and general destruction of tissue. They can be effective in small amounts. A drop the size of a pinhead produces a blister the size of a quarter. Blister agents are most effective in hot weather. Sweating increases the effect. The moist parts of the body are first affected. Blister agents are quick acting, although blisters may not appear for hours or even days after exposure. The skin does not begin to turn red before an hour or more, but the damage is done in the first few minutes. That is why speed is stressed in applying self-aid.

Damage to the eyes may be worse than the effects on the skin. There may be no pain, but in a few hours, eyes smart; they become inflamed and sensitive to light. Tears and intense pain follow. Permanent injury may result. Some blister agents cause immediate pain in the eyes.

If breathed into the lungs, blister agents inflame the throat and windpipe and produce a harsh cough. Serious exposure may produce pneumonia and death. Quick detection of blister agents plus protection against entry into the eyes, lungs, or on the skin is vital. Again, speed is essential.

Mustards. While seldom lethal, the mustard agents can cause prolonged incapacitation. They are alkylating compounds which destroy cellular DNA in the tissue they come in contact with. Mustard agents are related to compounds found in the textile and herbicide industries.

There is generally no pain on initial contact, except for the eyes. Initial signs and symptoms may not appear for 4 to 8 hours after exposure. The blisters usually appear 8 to 12 hours after contact. The initial signs and symptoms are very much like those of the choking agents, with the addition of erythema (reddening) and edema (swelling) of exposed skin. In severe cases—e.g., ingestion—bloody diarrhea and vomiting develop. Complications may also arise from pulmonary edema and secondary infections. These secondary infections are the leading cause of death (pneumonia predominates), due to a reduced white blood cell count and possible bone marrow depression.

Arsenicals. Arsenic, a mineral, has a long and effective history in war and peace. It disrupts the sulfulhydral enzyme system, stopping tissue metabolism. Arsenic can still be found in herbicides, pesticides, and some pharmaceuticals.

Direct contact with arsenicals causes almost instant, persistent stinging pain. Signs and symptoms evolve rapidly through headache, dizziness, severe eye pain, intense thirst, and throat pain. Muscular cramping (particularly of the face) and cold, clammy skin are accompanied by a rapid but feeble pulse. The individual will have cold extremities, and be cyanotic and stuporous. Later signs and symptoms include vomiting, profuse diarrhea, shallow breathing, convulsions, and a diminished urine output containing blood and albumin. The blisters on the skin may be confused with those of "mustard." Blisters are often well developed in 12 hours and are painful at first, in contrast to relatively painless mustard blisters. After about 48 to 72 hours, the pain should lessen.

Systematic poisoning by blister agents is manifested by a change in the permeability of the capillaries, causing hemoconcentration, necrosis, gangrene, and sloughing of tissue, shock, and death.

Other blister agents. Most of the other blister agents have the same signs and symptoms as for mustards. However, there is one which produces different signs and symptoms. The agent we are referring to is phosgene oxime or CX.

Phosgene oxime is an uriticant (needle gas) which produces an immediate sensation of pain, ranging from a mild prickling to a severe bee sting. About 30 minutes after exposure the skin will develop a blanched appearance with reddened "rings" followed a few hours later by a blister. Twenty-four hours after the exposure the blanched skin will acquire a brown pigmentation, and 5 to 7 days later a scab will form.

Nerve agents. The nerve agents are esters of organophosphorus compounds. They inhibit the cholinesterase enzyme system, causing a disruption of the nervous system. They can be found in the fertilizer and insecticide industries.

The onset of symptoms is rapid. Signs and symptoms of nerve agent exposure includes pinpointed pupils, difficulty in focusing eyes, headaches, general weakness, profuse sweating, tearing, and salivation (early). These will be followed by nausea, vomiting, and loss of bladder and bowel control (causing severe dehydration). If untreated, violent convulsions, coma, and death may be the result.

The first effect you will notice is probably a dimming of vision caused by pinpoint contraction of the pupils of the eyes. This is a vital tipoff. Other immediate symptoms are tightness of the chest, runny nose, nausea, stomach cramps, rapid breathing, and twitching muscles. It is imperative that nerve agents in contact with the skin or eyes be neutralized or removed immediately if the individual is to avoid becoming a casualty. These agents are lethal and are rapidly absorbed by the eyes and through cuts in the skin. They are absorbed through unbroken skin somewhat more slowly. Clothing contaminated with nerve agent must not be allowed to remain in contact with the skin. In order to save your life from the effects of nerve agents, speed is essential—speed in detection, speed in masking, speed in giving the alarm, and speed in self-aid.

Incapacitating agents.Incapacitating agents fall into two groups: those which produce temporary physical disability such as paralysis, blindness, or deafness; and those which produce temporary mental aberations such as confusion and hallucinations. The number of these agents is so numerous and varied in effect that they cannot be covered adequately in this course. Basically, an incapacitating agent is any type of material that will keep people from doing their job, thus detrimentally affecting the mission. These may cause an individual to become confused, disoriented, sleepy, excited, irritable, unconscious, etc. Some examples of incapacitating agents are marijuana, narcotics, an diarrheal chemicals.

Vomiting agents. The symptoms of an exposure to vomiting agents occur very rapidly. Symptoms such as feelings of fullness in nose and sinuses, (with pain in nose and throat), severe headaches, and pain and tightness in the chest may be present. Additionally, such signs as eye irritation, tearing, uncontrolled sneezing, and coughing may also indicate an overexposure to these agents. Runny nose and ropy saliva are followed by nausea and vomiting.

Tear agents. Even a brief exposure to tear agents produces sharp pain in the eyes and thus forces them closed. Prolonged exposure to tear agents produces reddening of eyes, irritation of the nose, and stinging of the skin.

Exercises (818):

1. How do blood agents affect the body?

2. In what type of weather are blister agents most effective?

3. Cite three examples of blister agents.

4. How do the effects of phosgene oxime differ from the other blister agents?

5. What is probably the first effect you will notice in a person exposed to nerve agents?

6. State other biological effects of nerve agents.

7. State the effects of incapacitating agents.

8. What are some effects of vomiting agents?

5-2. Chemical Agent Detection

This course does not go into detail on mechanical detection devices used to identify chemical agents. These devices require actual demonstration and practice. A brief introduction to them is provided in this section.

819. State how chemical agents are detected.

Detection Devices. While you might be able to detect some level of a chemical warfare agent with your five senses, you would be needlessly exposing yourself to potentially lethal levels. Since sensory impressions of chemical agents vary and are not always reliable, the best guide to detection and identification is the reliance on detection devices and tests made with the detector kits. The most widely available to the USAF are the M18A2 and M256 Chemical Agent Detector kits, the AN-M2 Water Test Kit, and the A/E 23D-3 Chemical Agent Alarm.

M18A2 Chemical Agent Detector Kit. This kit is primarily designed to be used by trained personnel for detecting dangerous concentrations of vapors, aerosols, and liquid droplets and chemical agents. The kit consists of detector tubes, tickets, and paper which are used alone or in combination with chemical reagents in the kit to produce distinctive color changes for positive results. The principal uses for the kit are: reconnaissance in areas of suspected contamination, delineating contaminated areas, determining absence of agents prior to unmasking procedures, testing the adequacy of decontamination procedures, and collecting samples of suspected but unidentified chemical agents. The M18A2 is capable of 15 series of tests for the following chemical agents:

- Nerve agents.
- Blood agents.
- Blister agents.
- Choking agents.

This kit is effective for both detection of agent presence as well as identification of the specific chemical agent, which is important for proper medical care. However, this kit does have the following limitations: The test results are based on color change which is qualitative; the small components of the kit are difficult to handle while wearing protective equipment; the full series of tests are time consuming; and the kit should be used by a two-man team. Because of the kit's ability to identify specific agents, it remains the primary choice for use by the USAF Medical Service.

M256 Chemical Agent Detector Kit. The purpose of this kit (fig. 5-1) is to detect and classify chemical agents present in air and in liquid form. The kit is capable of detecting the presence of nerve, blood, and blister agents in 15 minutes. The kit is an expendable item that consists of a carrying case, 12 sampler-detectors, and one book of detector paper (25 sheets). Each sample-detector consists of eight glass ampoules filled with a chemical reagent, three test spots, a chemical heater, and a lewisite detecting tablet. Instructions are included on cards in the carrying case and on the sampler-detector packets. The limitations of this kit are: colormetric and qualitative versus quantitative test results; very limited agent-specific identification; and no unknown sampling capability.

AN-M2 Water Test Kit. The AN-M2 chemical agents water testing kit is intended to be used to make limited qualitative tests for chemical agent contamination in potential drinking water sources. A positive test indicates that water cannot be used without purification. A negative test indicates that water from the source can be used safely for a period of 3 days after disinfection. This kit can be used to test 15 samples of water. the capabilities of the kit include specific tests for arsenicals, mustards, cyanogen chloride, and for the G-type nerve agents. The kit also has the capability for pH and chlorine demand tests. The pH and chlorine demand tests are not specific for any chemical agent, but a pH value of less than six or a positive chlorine demand indicates that a chemical agent may be present in the water. The kit does have the following limitations: The kit cannot detect trace levels of chemical agents; the kit has no V-type nerve agent capability; the kit cannot be used to test water that has been disinfected with either iodine or chlorine. V-type nerve agent detection capability can be achieved by using this kit in conjunction with the M18A2 detector kit or by using the ABC-M30A1 refill designed to restock the M18A2. The components of the kit consist of solid reagents, test papers, liquid-filled ampoules, sample bottle, test tubes, brush, and pipe cleaners. This kit will be replaced by the M272 Chemical Agent Water Test Kit, which should be available in the near future.

A/E 23D-3, Chemical Agent Automatic Alarm Set. The A/E 23D-3 Chemical Agent Alarm Set (fig. 5-2) is an automatic point detector for nerve agent vapors only. This unit operates on the ionization principle and provides continuous sampling through the use of the internal battery pack or the AC adaptor. Usually this unit is placed around areas such as the base perimeter alert area, or flightline, and is hooked up to a central alert system. Also, it can be used inside command posts, alert quarters, shelters, etc. The limitations of this unit are that it only detects nerve agent vapor and will alarm on pesticides, solvents, colored smoke (especially green), and jet engine or diesel exhaust. Due to these limitations, this unit is applicable to very limited situations.

Chemical Agent Detection Without Kits. While all chemical agent detection and identification should be accomplished using the appropriate kits, no doubt there will be times when either the kits are not available or when immediate determinations are needed. Remember, the kits should always be used first, but when necessary the following guidelines apply to chemical agent detection without kits:

a. Low flying aircraft. Aircraft equipped with spray

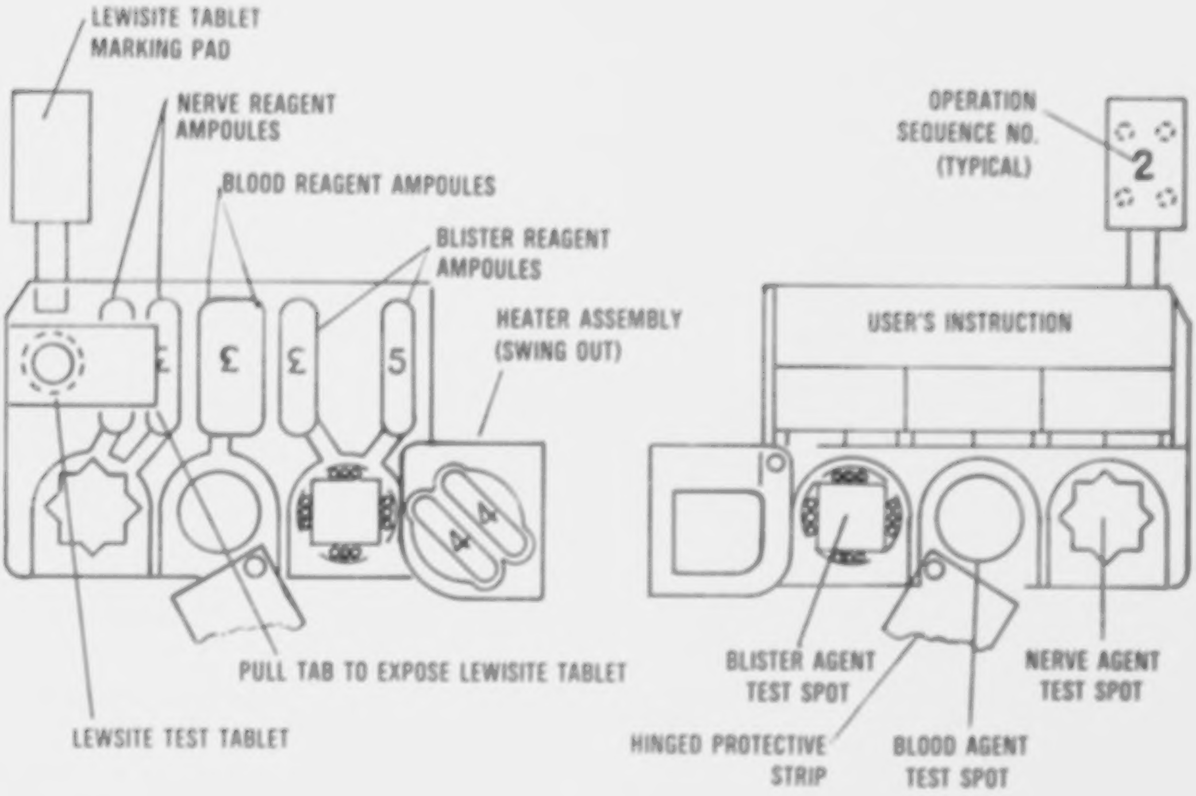


Figure 5-1. Chemical Agent Detector Kit.

tanks could be used to employ chemical agents. If enemy aircraft appeared to be crop dusting your installation, suspect chemical agents.

b. Defined areas of fog. Heavy concentrations of aerosol chemical agents would move across an area in a form similar to a cloud or fog. If weather conditions are otherwise clear and sunny, suspect chemical agents.

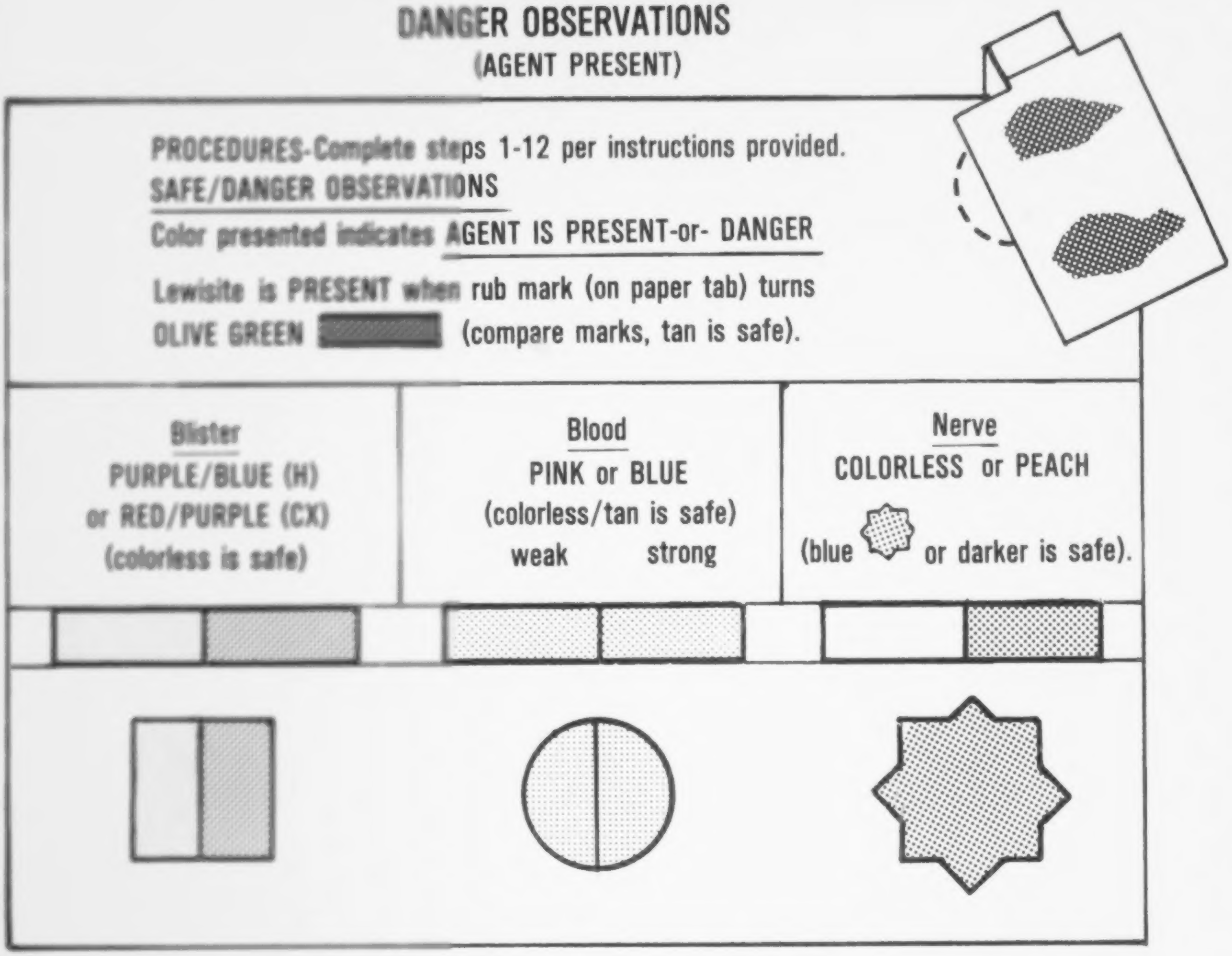
c. Spots on vegetation, rocks, buildings, etc. Liquid chemical agents have the same general appearance as motor oil. By observing the landscape you could determine if liquid agents were employed.

d. Observe effects on people or animals. A great deal of your medical readiness training is designed to teach you the signs and symptoms of chemical agent exposure. Your primary warning would be observing these effects on personnel caught without proper protective equipment. Also, remember that chemical agents are equally deadly to any wildlife in the area. Be sure to notice whether the wildlife such as insects and birds have been affected.

Unmasking Procedures. After determining the absence of agents, two or three individuals unmask for 5 minutes, then remask and are examined in a shady area for chemical agent symptoms. If none appear, the remainder of the personnel may safely unmask. It should be noted that bright light will cause contraction of the pupils which could be erroneously interpreted as a nerve agent symptom.

As an emergency field expedient when no detector kit can be obtained, two or three individuals are selected to take a deep breath, hold it, break the seal of their masks, and keep their eyes wide open for 15 seconds. They then clear their masks, reestablish the seal, and wait for 10 minutes. If no symptoms appear after 10 minutes, the same individuals again break the seal, take two or three breaths, and clear and reseal the mask. After another 10 minutes wait, if no symptoms have developed, these same individuals unmask for 5 minutes and then remask. After 10 more minutes, if no symptoms have appeared, the remainder of the group can safely unmask. However, they should all remain alert for the appearance of any chemical symptoms.

Environmental Health Team. It is the responsibility of the EH team to use these kits; initiate unmasking



DANGER OBSERVATIONS
(AGENT PRESENT)

PROCEDURES-Complete steps 1-12 per instructions provided.
SAFE/DANGER OBSERVATIONS
Color presented indicates AGENT IS PRESENT-or- DANGER

Lewisite is PRESENT when rub mark (on paper tab) turns OLIVE GREEN ▨ (compare marks, tan is safe).

Blister
PURPLE/BLUE (H)
or RED/PURPLE (CX)
(colorless is safe)

Blood
PINK or BLUE
(colorless/tan is safe)

Nerve
COLORLESS or PEACH
(blue ✷ or darker is safe).

Figure 5-1. Chemical Agent Detector Kit (cont'd).

procedures when necessary; and recommend precautionary measures for food, water, and medical facility contamination. A properly trained EH team member can identify a chemical agent in approximately 30 minutes. A more extensive survey, however, must be made to establish the extent of contamination especially in foodstuffs. This may require the assistance of others, depending upon the urgency or size of the medical facility.

Area Markers. Once the monitors have established the presence of contamination, the area should be marked with appropriate markers (fig. 5-3 and 5-4). In figure 5-4, the primary color is the color of the sign. The marking colors are the colors of any design of the area markers (e.g., bomb, stripe, etc.). The inscription colors are the color of the letters. Reports of the contamination, the extent of contamination, the type of agent identified, and the methods used for identifying the agent are forwarded by the most rapid means available through military channels to proper authority.

Exercises (819):

1. Why can't you use your "senses" to detect the presence of chemical agents?

2. Describe the three chemical agent detection kits.

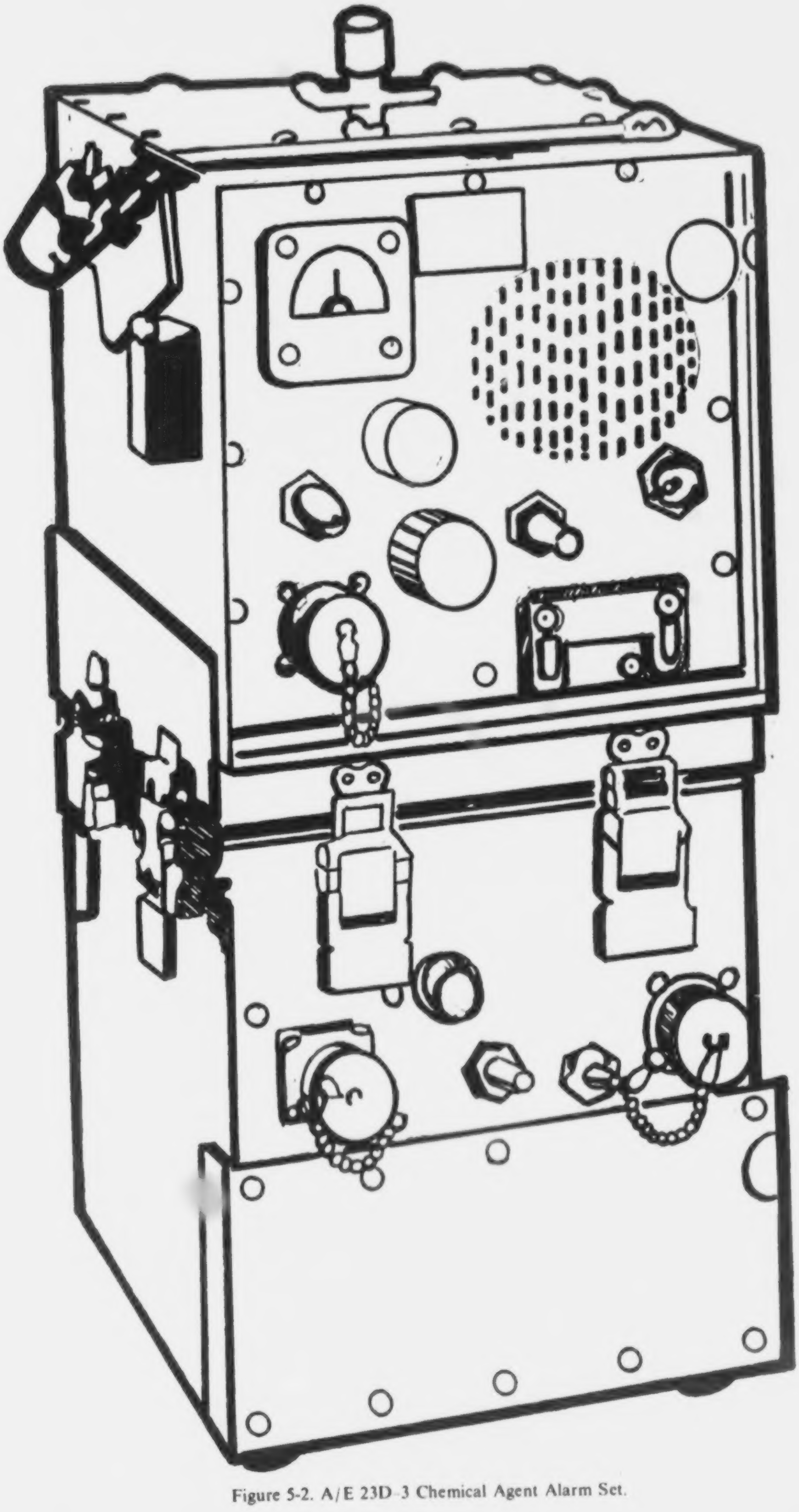


Figure 5-2. A/E 23D-3 Chemical Agent Alarm Set.

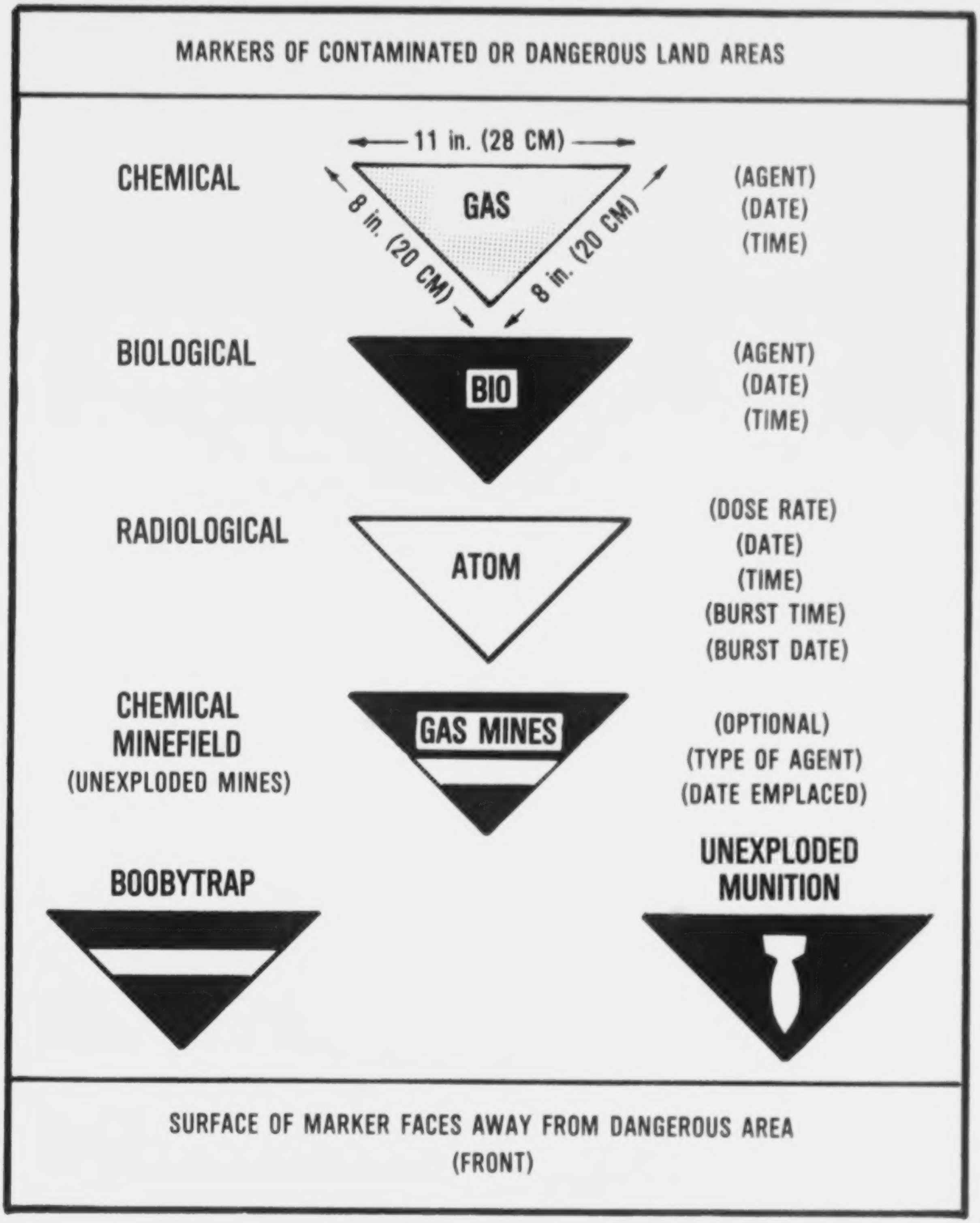


Figure 5-3. Identification marker of contaminated or dangerous land areas.

PRIMARY AND SECONDARY COLORS			
DANGER	PRIMARY COLORS	SECONDARY COLORS	
		MARKINGS	INSCRIPTIONS
RADIOLOGICAL CONTAMINATION	WHITE	NONE	BLACK
BIOLOGICAL CONTAMINATION	BLUE	NONE	RED
CHEMICAL CONTAMINATION	YELLOW	NONE	RED
CHEMICAL MINEFIELDS	RED	WHITE STRIPE	YELLOW
BOOBYTRAPPED AREAS	RED	WHITE STRIPE	NONE
UNEXPLODED MUNITIONS	RED	WHITE (BOMB)	NONE

Figure 5-4. Indicating colors of hazardous areas.

3. Cite characteristics of the chemical agent alarm.

4. During unmasking procedures (when no detector kit is available), which part of the body is initially exposed to detect the presence of chemical agents?

5-3. Personal Protection

This section describes the personal protective measures you can use to protect yourself against chemical agents. We will be discussing the types of protective clothing and some self-aid steps you may use in case of an attack with a chemical weapon.

820. State personal protective measures and self-aid for chemical agents.

Protective Clothing. Chemical and biological attacks have some things in common. Biological or chemical agents may be released in much the same manner. The agents may travel downwind and are affected by weather conditions. Most of these agents must enter the body before doing the greatest harm. Here, then, is the key to the protective measures that are common to both of these types of agents—learn to recognize the clues, try to get upwind, and use your protective mask and protective clothing. In every case of suspected chemical or biological attack, stop breathing until you don your protective mask. Your protective mask is the world's best. If properly adjusted, it protects your face, eyes, and lungs from most known BW and CW agents.

Protective clothing helps protect the skin against most agents. Impregnated clothing or two layers of ordinary clothing protect you against vapors or blister agents. Impregnated clothing does not protect against liquid chemicals. Droplets of liquid blister or nerve agent quickly go through impregnated cloths. Any part of your clothing that becomes contaminated by liquid agents must be ripped off immediately. Skin must be decontaminated. To protect you against droplets or splashes of liquid agents, you may be issued a protective cover. This serves the same purpose as a raincoat.

When a chemical agent is present in liquid form, you are almost certain to get it on your shoes. A protective leather dressing that makes shoes resistant to chemical agents is available. It does not neutralize the agent, it just delays penetration into the leather. Decontaminate footwear as soon as possible.

Protective Masks. We have already mentioned the use of protective clothing. The use and care of the protective mask should be well known to you. But let's quickly review some important points. Your protective mask is as vital in a CW attack as a life jacket is to a sailor overboard. These masks, when properly fitted and worn with the hood, give protection against field concentrations of all known enemy chemical agents in vapor or aerosol form by filter elements that fit in the cheeks of the facepiece. They filter the contaminated air to remove the agents but they do not produce oxygen. When the air has a low oxygen content or when individuals are in tunnels or caves with a heavy concentration of aerosolized particles such as burning smoke mixtures, the protective mask will not provide breathable air. The M17-series masks also do not protect against ammonia vapors or carbon monoxide. These masks are commonly referred to as the "protective masks," "gas mask," or "mask," as may be appropriate; however, protective mask is the preferred term.

As stated previously, the M17A1 is the standard A field protective mask. It has an accessory, a resuscitation tube, for giving mask-to-mouth artificial respiration by a masked individual to an individual casualty in a contaminated atmosphere. It has the following components: a voicemitter to facilitate communications and a device for drinking water from the canteen while masked (including a water canteen). Remember, you are responsible for proper care of the mask as well as all other items of your protective equipment. Inspect it frequently for damage and cleanliness.

Self-Aid. Several references have been made to self-aid. In most cases, you do not have time to get help; you must be your own aid-man. You must take the following steps to protect yourself in a chemical attack:

(1) Quickly detect the presence of chemical agents.

(2) Use your protective equipment.

(3) Give yourself quick and correct self-aid when contaminated.

(4) Avoid the areas where chemical agents exist.

(5) Decontaminate your equipment and yourself as soon as possible. The best course, if possible, is to avoid contamination. This is not always possible. It may be possible, however, to remove yourself from the contaminated area by moving upwind or seeking high ground. Gas is usually heavier than air and tends to settle in low places.

Exercises (820):

1. What are the key things to remember in order to protect yourself against chemical (and biological agents)?

2. In every case of a suspected chemical and biological attack what should you do until you can don your protective mask?

3. State the steps of self-aid to use in a chemical attack.

4. In case of a chemical attack where should you go?

5-4. Personnel Decontamination

Immediate self-aid, including personal decontamination, is all important if you are exposed to liquid nerve or blister agents.

821. State the personal decontamination procedures and first-aid measures for chemical agents.

Unknown Agents. The need for speed cannot be overemphasized since there are definite time limits after which first-aid becomes useless. You may not know whether the contamination is a liquid nerve agent or liquid blister agent; so, the following procedures are generally recommended:

(1) Don mask and clear it.

(2) Remove liquid agent from skin with M258 or M258A1 skin decontamination kit.

(3) If effects of nerve agents become apparent, use an atropine injection.

In most cases the individual will not be able to immediately identify the chemical agent used in an attack. When exposed to an enemy chemical attack while dressed in chemical protective clothing and equipment, a person will not normally be concerned with immediate decontamination. However, if an individual believes that he or she has been contaminated by an unidentified agent, perhaps while unmasked, he or she takes the actions described below.

Decontamination of eyes and face. If the eyes and face have been contaminated, the individual must immediately try to get under cover. Shelter limits further contamination during the decontamination process. If no overhead cover is available, throw a poncho over the head before beginning decontamination. Then decontaminate:

(1) Eyes by turning the face upward and using water from a canteen to repeatedly flush the eyes.

(2) The facial skin by using the components of the M258 skin decontaminating kit. When doing this do not let the solution from the M258 kit get in the eyes. If necessary, you may decontaminate the inside of the protective mask with the small pad from the M13 kit.

Decontamination of skin. If any other skin areas have been contaminated (for example, the back of the neck), this skin is also decontaminated using the M258 kit or soap and water. This procedure should also be followed for skin that was in contact with contaminated clothing before it could be removed.

Known Agents. If the agent has been identified, employ the procedures for the specific agent. The initial steps of self-aid for all chemical agents are the same. They are:

(1) Remove individual from the contaminated area, thereby terminating the exposure.

(2) When applicable remove clothing and scrub skin.

(3) Wash eyes and gargle with a two percent baking soda solution.

(4) Seek medical attention if individual does not respond immediately.

Mustard agents. When irrigating the eyes, flush them with the baking soda solution for at least 30 seconds and not more than 2 minutes. Seek medical attention if eye problems, breathing problems, or blisters cover more than 20% of the body or if blisters develop in a critical area (i.e., genital area, hands, etc.).

Nerve agents. Give intermuscular (IM) injections of the following;

a. Atropine sulfate, 2 mg in 2 ml solution; give one injection every 10 minutes up to a total of 3 injections.

b. 2-PAM chloride, 600 mg in 10 ml solution; give one injection every 10 minutes up to a total of three injections.

Seek immediate medical attention; this is a holding action only until the person can be treated by a physician. Additionally, the current AF policy provides for the issuing of a drug (pyridostigmine) as a pretreatment in the case of a nerve agent attack.

Vomiting agents. Vigorous activity reduces the time and severity of the symptoms.

M258 Skin Decontaminating Kit. The M258 Skin Decontaminating Kit (fig. 5-5) provides for a portable fast method of decontaminating the skin of liquid nerve and blister agents. The M258A1 is a newer version of the M258. Both kits decontaminate the skin; only the method of application is different. When the solution in capsule I (or packet 1) is applied, it neutralizes V and II (or packet 2) is then applied, which will neutralize G agents and the caustic substance caused by capsule I (or packet 1).

Exercises (821):

1. If the chemical agent is unknown, state the appropriate first-aid procedures.
2. Cite initial first-aid steps for personnel exposed to chemical agents.
3. What additional treatment may be necessary for personnel exposed to nerve agents?
4. How can the time and severity of the symptoms of vomiting agents be reduced?

5-5. Chemical Agent Detection and Decontamination of Food Supplies

With the heightened awareness of the threat of chemical warfare has come an increasing concern for what to do with chemically contaminated food and water. Contamination of foodstuffs by chemical warfare agents may occur from contact with vapor, aerosol, sprays or splashes of liquid, or smokes of solid chemicals. Unprotected food, forage, and grain supplies may be so contaminated that their consumption will produce gastrointestinal irritation or systemic poisoning. The nerve and blister agents are the most dangerous. Although there is no all-inclusive publication on the decontamination of food items, there is a great deal of information available on the handling of potentially contaminated food. The following is a compilation of this information.

822. State how food containers protect food and the ways containers can be decontaminated.

Container Protection. The first consideration in food handling in a chemically contaminated environment involves the possible degree to which the food item has been contaminated. It stands to reason that if the container has been damaged from a detonation of a chemical round, the contamination will be severe. We will therefore concern ourselves with items exposed to a heavy vapor. First of all, certain types of packaging afford ample protection from heavy vapor. They are:

a. Sealed glass.

b. Sealed cans.

c. Sealed wooden barrels.

d. Sealed fiberboard.

e. Sealed foil (metal).

Applying this rationale, it follows that items inside sealed, undamaged refrigerators, freezers, or vans would be moderately protected. Additionally, other food supplies in storage are not likely to be seriously contaminated if reasonable precautions are taken to protect them against chemical attack. For this reason, large supplies of food should not be condemned "en masse" simply because they have been exposed to the possibility of chemical contamination. A prompt and careful survey of the supplies may reveal that only a few items have been so seriously contaminated as to require special treatment. Prompt segregation of heavily contaminated items will minimize contamination of the rest of the lot. Generally, foods not specially packed in protective packages constitute the major difficulty. The type and extent of contamination, the availability of replacement supplies, and available means of decontamination will determine if reclamation of the contaminated items is worthwhile.

Chemical Agent Detection. As we stated previously, the Chemical Warfare Test Kit, M18A2, provides a simple and rapid field test for detection of chemical poisons in foods and food packages. Analytical procedures have been developed to employ as fast as possible dry solid reagents and test papers to make the test as simple as possible. The kit is designed to detect dangerous concentrations of the nerve gases, mustard gas, nitrogen mustards, the arsenical blister gases, and the arsenical smokes on food and food packages. The booklet issued with the kit gives specific directions for each test. A kit should be maintained in the Environmental Health Service office.

Water is monitored for chemical contamination with the Water Test Kit, Chemical Warfare Agents, AN-M2. An important point to remember is that the decontamination of water contaminated with chemical

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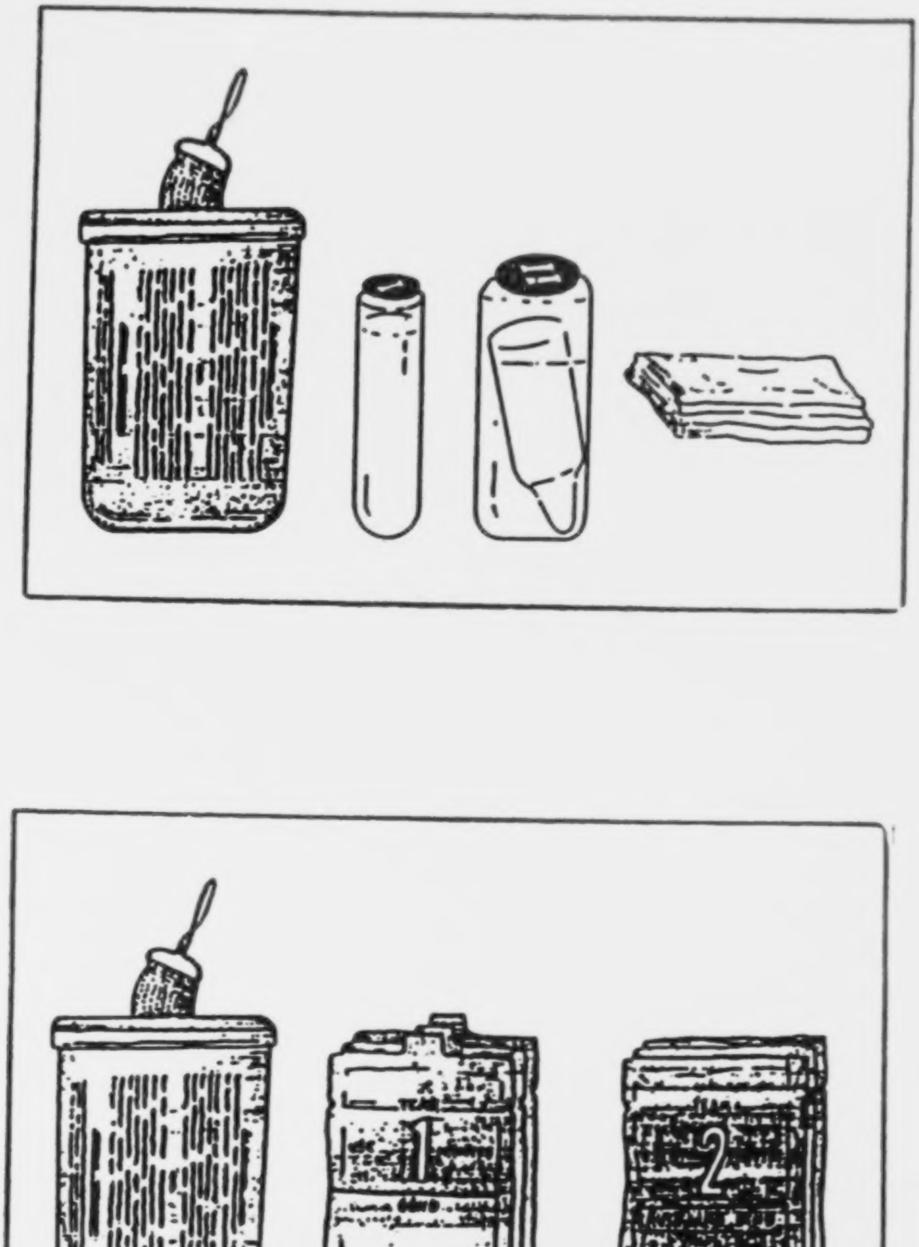

Figure 5-5. M258 Skin Decontamination Kit.

warfare agents is difficult and requires chemicals and equipment not regularly issued to personnel in the field. Only trained water purification personnel should undertake the complex water decontamination procedures.

Sealed Container Decontamination. In order to use sealed, undamaged packages of food, it is still necessary to decontaminate the exterior of the container prior to opening. The following chemical agents can be removed and or neutralized by wiping or rinsing with either a 2 percent solution of sodium bicarbonate or a 5 percent solution of chlorine: (See AFR 355-7, *Military Chemical and Chemical Agents*, and Appendix B for a listing of the letter codes.)

CG
DP
PS
AC
CK
CX
SA
GA
GB

The following chemical agents can be removed and/or neutralized by boiling for 30 minutes, or by soaking for 2 hours in either a 5 percent sodium bicarbonate solution or a 10 percent solution of chlorine:

HD
HN
L
PD
ED
MD
HT
HL
GD
VX

Food Vulnerability. Next we must consider what to do about foods that are not completely protected by packaging materials. It is possible to decontaminate many different food products from a variety of different contaminants. You must, however, consider two facts when considering methods: what is the chemical contaminant and what food product are you dealing with.

The following information is from the US Food and Drug Administration. It was derived from original research conducted by the United Kingdom. You may note that it is slightly contradictory to current US military literature (but only at first reading). We are dealing with *vapor* contamination, not liquid.

a. Foods with high moisture content or a crystalline structure (vegetables, fruits, sugar, etc.) *will not* absorb or retain significant amounts of mustard vapor.

b. Foods with a low moisture content, a low to average fat content, and an amorphous structure (dried fruits, cereal, coffee, etc.) will absorb mustard vapor temporarily, but release it readily upon airing.

c. Foods with a high fat content (butter, cheese, fish, etc.) absorb and retain mustard vapor in their surface layers.

d. Nerve gas vapor penetrates food similarly, has a slightly greater retention rate, and hydrolyzes slightly more readily than mustard.

e. Mustards, arsenicals, and nerve agents are readily soluble in fats. Because of the diffusion throughout the material it may be impossible to remove them.

f. Coagulation of protein by agents such as the arsenicals may limit diffusion of these agents in high protein foods.

g. Hydrolsis of acid-forming gases in foods of high water content produces decomposition products which render the food unpalatable.

h. Foods with low moisture and low fat content will be less easily contaminated and less difficult to contaminate.

Emergency Situations. In a true emergency situation (war and its variations) the idea of throwing anything away is logistically undesirable. It will be easier, faster, and more cost effective to use every available item rather than to await resupply. For this reason the following procedures are recommended:

(1) Segregate suspected items.
(2) Inspect items for contamination.
(3) Decontaminate as possible.
(4) Reinspect as possible.
(5) Dispose of "grossly" contaminated items.
(6) Reissue items demonstrated to be safe following reinspection.

Generally, you could anticipate a massive and rapid resupply in the event of war. However, you may find yourself isolated from normal logistical support, so we have included a last resort decontamination of foods' procecure to follow if this should happen. Note tables 5-1, 5-2, and 5-3 are the "ideal" decontamination procedures (i.e., you have plenty of food and you know the specific agent that was used). However, you know these conditions will not always be the case. The following is not the "high tech" world and it's risky at best, but as the title implies, you have to draw-the-line somewhere. Of course, this is the very bottom line, *do-it-or-starve* food decontamination process. This emergency decontamination procedure does not come with any guarantee. You might still be getting enough poison to make you ill (or worse). Again, we are dealing with vapor exposure, not liquid.

Meat. Trim away all surface fat and badly contaminated spots. Wash or soak the meat in a 2 percent sodium bicarbonate solution for 30 minutes. Be sure to discard solution prior to cooking and serving. You can make a 2 percent bocarbonate solution by putting 1 pound of baking soda in 5 gallons of water.

Fatty foods. Trim fatty foods to a depth of 1 inch, being careful to clean the knife after each individual cut.

Flour. Flour stored in sacks can be placed in air for several days (3 or 4), then reinspected. If it is still contaminated, empty it from the sacks and aired for several more days (3 or 4).

Sugar. If sugar is slightly contaminated, aeration will decontaminate it. If heavily contaminated, then it must be refined.

Granular foods (in bags). For a slight contamination of granular foods, empty bags and air for several days (3 or 4), then reinspect. For a heavy contamination, granular foods must be condemned and buried.

Dried fruit. Boil dried fruit for 1 hour in a 2 percent sodium bicarbonate solution, drain, and use promptly.

Fruits/vegetables. Fruits and vegetables must be hosed down with water for 5 to 10 minutes, then aired for 24 hours. Leafy vegetables exposed to heavy vapor or liquid should be condemned and buried.

Grain (stored in bulk). Remove 4 to 6 inches of outer surface and destroy this amount you remove. Allow remaining grain to air for several days (3 or 4).

TABLE 5-1
FOODS WITH HIGH MOISTURE CONTENT, RESISTANCE COVERING, OR CRYSTALLINE STRUCTURE. EXAMPLES: FRESH FRUITS, VEGETABLES, EGGS, GELATIN, SUGAR, AND SALT

AGENTS	*DECONTAMINATION*
CG CX DP PS AC	24 hours aeration or soak for 2 hours in 2% sodium bicarbonate or 5% chlorine. Peel or pare as desired.
HD HN HT VX GA GB	30 minutes boiling in 2% sodium bicarbonate or 5% chlorine or rinse 5 times with 5% sodium bicarbonate then rinse twice with clean water.
HL PD ED MD SA CK L	Destroy.

TABLE 5-2
FOODS WITH LOW MOISTURE CONTENT, LOW TO AVERAGE FAT CONTENT, OR NON CRYSTALLINE STRUCTURE. EXAMPLES: DRIED FRUITS AND VEGETABLES, CEREALS AND CEREAL PRODUCTS, TEA, AND COFFEE

AGENTS	*DECONTAMINATION*
CG DP AC PS CX	24 hours aeration.
HD HN HT VX GA GB GD	30 minutes soaking in 2% sodium bicarbonate solution prior to cooking.
HL PD ED MD SA CK L	Destroy.

TABLE 5-3
FOODS WITH HIGH FAT CONTENT. EXAMPLES: BUTTER, LARD, CHEESE, VEGETABLE OIL, FATTY MEATS, AND FISH

AGENTS	*DECONTAMINATION*
CG DP PS AC AC GA GB	Wash with 2% sodium bicarbonate and air dry.
HD HN HT HL GD VX CK SA PD MD ED L	Destroy.

In this section we have used the assumption that food items were hit directly with a chemical weapon and thereby received heavy liquid contamination or sustained damage to the primary container and are beyond salvage.

Remember, this is last resort decontamination of food. Again, you need to know some basic things:

(1) The chemical.
(2) The nature of contamination (vapor/liquid).
(3) The nature of the food.
(4) A practical method for decontamination.

If you don't have all four you can "throw it all out," or play the old game of "you bet your life."

Exercises (822):

1. Using table 5-1, how would fresh fruits contaminated with CG or DP be decontaminated?

2. Using table 5-3, how should cheese or fish be contaminated if the contaminant is HD or GD?

3. In a true emergency situation, what decontamination procedures should be followed for supplying food to the personnel?

4. Describe "last resort" contamination procedures for meat contaminated with a chemical warfare agent vapor.

5. What are some basic things you must consider any time you resort to using last resort measures to decontaminate food?

Bibliography

Department of the Air Force Publications	***Behavioral Objectives***
AFR 160-25, *Medical Readiness Planning.*	800,801
AFR 355-1, *Planning and Operations.*	800
AFR 355-7, *Military Chemistry and Chemical Agents.*	822
AFM 160-12, *Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries Appendix D—Chemical Contamination of Food, Forage and Grain.*	822, 818, 822
AFP 161-3, *NATO Handbook on the Medical Aspects of NBC Defensive Operations.*	801, 804, 813, 814, 815, 816, 819
Department of Army Publications	
TM 3-220 (US Army), *Chemical, Biological and Radiological (CBR) Decontamination.*	806, 810, 811, 812, 816, 817, 820
Department of Navy Publications	
NAVPERS 10899-B, *Disaster Control Ashore and Afloat.*	802, 803
Federal Publications	
Civil Defense for Food and Drug Officials. Office of Civil Defense, Government Printing Office, Washington D.C., 1965.	807, 812, 818, 822

Glossary

Absorption—The internal taking up of one material by another.

Alpha Particle—A helium nucleus, consisting of 2 protons and 2 neutrons, with a double positive charge.

Amplification—As related to detection instruments, the process (either gas, electronic, or both) by which ionization effects are magnified to a degree suitable for their measurement.

Beta Particle—A charged particle emitted from a nucleus and having a mass and charge equal in magnitude to those of the electron.

Biological Agent—Microorganism that produces disease in man, animals, or plants or causes deterioration of material.

Chemical Agent—A solid, liquid, or gas, which through its chemical properties, produces lethal, injurious, or irritant effects on man, animals, or plants; a colored smoke for signaling; a screening smoke; an incendiary.

Chemical Casualty—A person who has been affected sufficiently by a toxic chemical agent as to render him or her incapable of performing his or her duties. (A casualty may be either disabled or dead.)

Duration of Effectiveness—The length of time an agent will remain in an area in effective concentrations. Expressed as persistent or nonpersistent.

Gamma Ray—A high-frequency electromagnetic radiation with a range of wavelength from 10^{-9} to 10^{-10} cm, emitted from the nucleus.

Half-Life—The time required for one-half of the atoms of one element to decay by radioactivity into another element.

Half-Thickness—The thickness of absorbing material necessary to reduce the intensity of radiation by one-half.

Ion—An atomic particle, atom, or chemical radical (group of chemically combined atoms) bearing an electrical charge, either positive or negative, caused by an excess or a deficiency of electrons.

Ionization—The act or result of any process by which a neutral atom or molecule acquires either a positive or a negative charge.

Neutron—An elementary nuclear particle with a mass approximately the same as that of a hydrogen atom and electrically neutral; a constituent of the atomic nucleus.

Persistency—An expression of duration of effectiveness of a chemical agent. Persistency is dependent of physical properties of the agent, weather, methods of dissemination, and conditions of terrain.

Radiation—A method of transmission of energy. Specifically:

(1) Any electromagnetic wave (quantum).

(2) Any moving electron or nuclear particle, charged or uncharged, emitted from the atom.

Radioactivity—The process whereby certain nuclides undergo spontaneous atomic disintergregation in which energy is liberated, generally resulting in the formation of new nuclides. The process is accompanied by the emission of one or more types of radiation, such as alpha particles, beta particles, and gamma radiation.

APPENDIXES

Appendix A. Listing of NBC Equipment.

Appendix B. Chemical Agent Reference List.

APPENDIX A

NBC EQUIPMENT

Instrument	**Agent Detected**	**FSN/NSN**	**TO Directive**
Radiation Detection			
AN/PDR-27 Series	beta/gamma	6665-00-543-1443	11H4-7-3-121
AN/PDR-43	beta/gamma	6665-00-474-4186	11H4-7-3-131
CDV-715	beta/gamma	None	None: Use owners manual.
PAC-1S (AN/PDR-60)	alpha	6665-00-960-1288	11H4-2-31 thru 11H4-4-2-34
AN/PDR-56	alpha (gamma)	6665-00-113-9530	11H4-7-3-211
Chemical Agent Detection			
M18A2 Kit	Vapor, aerosol, and liquid droplets of chemical agents	6665-903-4167	11H2-5-1
M256 Kit	Nerve, blood, Blister agents	6665-01-016-8399	11H2-5-10-1
AN-M2 Water Test Kit	Arsenical, mustard, nerve agents	6665-171-9747	11H2-7-1
A/E 23D-3 Automatic Alarm	Nerve agent vapors	6665-01-038-8562	11H2-8-1

APPENDIX B

CHEMICAL AGENT REFERENCE LIST

	MILITARY CODE	Dept. of Trans. ID Number(s)	TRIVIAL NAME	Chemical Name(s)
Smoke	HC	1840		Zinc chloride solution
	FM	1838		Titanium tetrachloride
	FS	1829/ 1754		Sulfur triozide (55%) and Chlorosulfonic acid (45%)
Riot Control	CS	1693		o-chlorobenzylidene malononitrile
	CA	1694		Bromobenzylcyanide
	CN	1697		Chloroacetophenone
	CNB	1846/ 1114/ 1697		Chloroacetophenone (10%) Carbontetrachloride (45%) and Benzene (45%)
	CNC	1888/ 1697		Chloracetophenone (30%) and Chloroform (70%)
	CNS	1580/ 1888/ 1697		Chloroacetophenone (23%) Trichloronitromethane (38.4%) and Chloroform (38.4%)
Vomiting	DA	1699		Diphenylchloroarsine
	DC	not commercial		Diphenylcyanoarsine
	DM	1698	Adamsite	Diphenylaminochloroarsine
	CG	1076	Phosgene	Carbonal chloride
	DP	not commercial	Diphosgene	Trichloromethyl chloroformate
	PS	1580	Chloropicrin	Trichloronitromethane
	AC	1051	The Flash	Hydrogen cyanide
	CK	1589	Canister Cracker	Cyanogen chloride
	L	not commercial	Lewisite	Dichloro (2-chlorovinal) arsine
	PD	1556		Phenyldichloroarsine
	ED	1892		Ethyldichloroarsine
	MD	1556		Methyldichloroarsine
	SA	2188	Arsine	Arsenic trihydrite
	HD	not commercial	Dist. Must.	Bis (2-chloroethyl) sulfide
	HN-1	not commercial	Nitrogen 1	2,2,dichlorothiethylamine
	HN-2	not commercial	Nitrogen 2	2,2^1,dichloro-N-methyldiethylamine
	HN-3	not commercial	Nitrogen 3	2,2,2 trichlorotriethylamine
	CX	not commercial	Phosgene Oxime	Dichloroformoxine
	HL	not commercial	HL mix	Distilled Mustard and Lewisite
	HT	not commercial	HR mix	Distilled Mustard and a chlorine and sulfur compound
	GA	not commercial	Tabun	Ethyl N, N-diethyl phosphoramidocyanide
	GB	not commercial	Sarin	Isopropyl methylphosphonofluoridate

GD	not commercial	Soman	Pinacolyl methylphosphonofluoridate
VX	not commercial	Agent A	o-ethyl (2-diisopropylaminoethyl) methyl phosphonothioate

*Note: IAW AFR 355-7, U.S. policy on chemical warfare does *not* consider smoke, riot control, and vomiting compounds to be "Chemical Warfare Agents."

Answers to Exercises

CHAPTER 1

Reference:

800 - 1. To set up the framework and necessary procedures to successfully accomplish patient care and any related medical support tasks that would be expected as a result of a disaster or wartime situation.

800 - 2. Fires, floods, earthquakes, tornadoes, riots, and nuclear, biological or chemical accidents.

800 - 3. That communication is established.

800 - 4. CPR, water safety instructor, life saving techniques.

801 - 1. Environmental Health Team.

801 - 2. Bioenvironmental engineering personnel.

801 - 3. The detection and identification of NBC agents in the medical treatment facility and base food supplies; medical treatment; field sanitation; and disease surveillance.

801 - 4. Patient care.

801 - 5. A sorting of patients, depending on their condition, in order to provide the fastest and best medical treatment with available resources.

801 - 6. Assistance in evaluating the medical aspects of selecting a suitable shelter and information about the effects of NBC warfare and peacetime disasters.

CHAPTER 2

802 - 1. Because they can cause loss of human life as well as tremendous property damage. Additionally, thunderstorms usually develop locally and frequently there is little time to prepare for them.

802 - 2. A violent windstorm occurring with much rain, thunder, and lightning, usually with rotating winds around the eye of the storm.

802 - 3. Tornadoes.

802 - 4. An area of low barometric pressure which causes buildings in the path of the tornado to be lifted up and explode.

802 - 5. Condition IV, III, II, I.

802 - 6. Make sure building structures are kept in "good" structural condition; guard areas against washing away by a storm; sandbag surroundings; cover window panes; place vehicles and equipment in protective shelter; and provide adequate water for fire fighting.

803 - 1. Wash away buildings and structures as well as farmlands; destroy roads, buildings, vehicles, and other equipment.

803 - 2. Because they usually occur without warning.

803 - 3. The sea withdraws from land for a period of several minutes to an hour, then plunges toward the shore at a phenomenal speed.

803 - 4. Volcanic eruptions occur in cycles. An eruption is followed by a quiet period in which pressure is built up for another eruption.

803 - 5. A fire storm is an atmospheric disturbance caused by a large fire wherein a column of rising, heated air causes a strong wind (fire wind) which may reach gale proportions. This wind feeds the fire, causing it to burn more intensely.

803 - 6.
(1) Those which develop from fires that begin in hazardous industrial areas and usually spread before they can be controlled.
(2) Those which arise from fires in closely built housing areas.
(3) Those that develop from forest fires or brush fires.
(4) Those which grow from explosions and cause fires over a wide spread area.

804 - 1. Airblast, shock wave, and flying missiles.

804 - 2. Overpressure or position phase and a negative pressure or suction phase.

804 - 3. *Occupational Health Guidelines for Chemical Hazards; Occupational Diseases; A Guide to Their Recognition; Pocket Guide to the Chemical Hazards;* and the *Hazardous Materials: Emergency Response Guidebook.*

805 - 1. Unexpected peacetime nuclear weapon accident.

805 - 2. Damage, malfunction, or failure of a nuclear weapon has occurred which makes it unsafe or nonoperational.

805 - 3. Explosive hazards.

805 - 4. Because it is a bone seeker with a biological half-life of 200 years. Thus it would take our body approximately 200 years to get rid of half of the radioactivity if this radioactive material got inside the body.

805 - 5. Tritium and uranium. If nuclear detonation did occur stronium-90 and iodine-131 would also be present.

805 - 6. Beryllium (inhalation), lead (inhalation, ingestion and skin absorption), and lithium (skin).

806 - 1. Resuspension of the radioactive particles which can get into the body and contaminate our food.

806 - 2. Coveralls, shoe covers, gloves, head cover, and M-17 protective mask.

806 - 3. Headgear, outergarments, boots, gloves, socks, underclothing, and then the protective mask last.

806 - 4. By the effectiveness and availability of decontaminating agents and the value of the equipment to be decontaminated. If the equipment is not expensive it may be preferable to dispose of it.

807 - 1. Patient care, field sanitation disease control, and inspecting and protecting existing food supplies.

807 - 2. Was the electricity off; what chemicals were used to extinguish a fire (if one occurred); how damaged are any salvageable foods; have arrangements been made to remove the "safe" foods from the disaster site.

807 - 3. Vending machines; food handling, storage, and transportation facilities; kitchens; bakeries; etc.

807 - 4. Protect existing supplies from rodents and other vermin; education of population on how perishable foods can be preserved longer and on the proper location of eating areas.

CHAPTER 3

808 - 1. People may be injured or killed by the flying missiles. Those indoors and outdoors may be injured as a result of blast damage to the structure, and people may be burned by primary and secondary fires caused by the blast.

808 - 2. Fires from the explosion and fires caused indirectly by the blast.

808 - 3. It would produce little or no radiation hazard on the ground.

808 - 4. Subsurface burst.

808 - 5. The finely divided radioactive particles from the burst attach themselves to larger dust particles or water particles which may become airborne.

809 - 1. Radioactivity detection identification and computation; in other words, an instrument used to measure radioactivity.
809 - 2. Total dose and dose rate.
809 - 3. Pocket dosimeters and TLDs.
809 - 4. X ray and gamma radiation.
809 - 5. The detector probe is removed from the well, and the beta shield is moved aside.
809 - 6. Handle the instrument carefully, keep it dry, allow 2 minutes for the equipment to warm up, protect the batteries.
809 - 7. AN/PDR-43.
809 - 8. Gamma.
809 - 9. PAC-1S.

809 - 10. Counts per minute (cpm).
809 - 11. A wet surface cannot be monitored sufficiently for alpha contamination with the PAC-1S.

810 - 1. Permeable and impermeable protective clothing.
810 - 2. In the presence of vapors or a fine spray of chemical agents.
810 - 3. For protection against rain.
810 - 4. Rip off the portion that has wetted.
810 - 5. Liquid chemical agents; biological agents; and radioactive dusts.

811 - 1. First, contaminated clothing is properly removed; then they can be decontaminated. If contaminants have infiltrated the pores of the hands and can't be removed, then surgical gloves are worn for 30 minutes by the person. The final step in contamination is a complete body shower with special attention paid to the hair, hands, and fingernails. Cuts and wounds should be monitored for contamination, flushed out with plenty of water, and if still contaminated, scrubbed with soap and then rinsed with water.
811 - 2. Brushing.
811 - 3. Brushing, washing, and aging.
811 - 4. Wear protective masks, brush or shake from the upwind side, monitor equipment and yourself at the completion of work.
811 - 5. When washing fails and the equipment is too valuable to be destroyed or buried.
811 - 6. Permanent, semipermanent, and temporary.
811 - 7. The location of a water source as well as the location of the facility in relationship to other important agencies (hospital, fallout station, etc.).
811 - 8. From a contaminated area to a less contaminated area or uncontaminated area.

812 - 1. Probably very little if the container is still intact. The outside of the container can be decontaminated by washing and scrubbing. The inside food contents are considered safe (i.e., free from radioactive contamination). Care should be taken not to accidentally transfer contamination to the food surfaces when the packaging material is removed.
812 - 2. Peeling, scraping, washing, or scrubbing.
812 - 3. If they are within a short distance from the blast site, they will probably be completely destroyed by the heat and pressure. Overpressure and high winds may damage meat tissue, increasing the rate of deterioration. Trim away the damaged/spoiled section; monitor for fallout contamination, and cook. Scrub live animals with soap and water and then slaughter, throwing away the internal organs.
812 - 4. It replaces calcium in the body when ingested.
812 - 5. Common sense; monitor for radiation and trim the affected areas.
812 - 6. Canned meats, wash containers and remonitor; carcass beef, trim away (1/4 inch) the contaminated fat layer; boxed or wrapped meats, clean off all dust carefully and open and monitor the product.

CHAPTER 4

813 - 1. From mortar and artillary shells, bombs, airplane spray, missiles, or by various methods of sabotage. Additionally, vectors may carry the infective organism.
813 - 2. Flies, mosquitos, fleas, ticks, and lice and their animal hosts.
813 - 3. Widespread explosive disease epidemics would not be expected in areas where good sanitation, hygiene, quarantine, immunization, and treatment practices are used. There would probably be many small outbreaks of disease. If detected soon enough, the illness resulting from these infectious diseases could, in most cases, be treated.

814 - 1. They have delayed action, we can't detect them with out unaided senses, and identification of the organism is often difficult.
814 - 2. The ability of the agent to overcome the resistance of the host.
814 - 3. Aircraft dropping or spraying an unidentifiable material; bombs that burst with little or no blast; unknown smoke or mists; unusual bottles or breakable containers lying around; unusual numbers of sick or dead animals.
814 - 4. Prompt reporting of sickness and maintaining adequate sanitation, immunizations, quarantine, and treatment practices.
814 - 5. Diagnosis can be made by analyzing material taken from sick animals, plants, and people, or from observing their symptoms. Certain clues can also warn you of a BW attack; i.e., aircraft dropping strange materials, bombs with little or no bursts, smokes or mists of unknown origin, large numbers of sick or dying animals, etc.

815 - 1. Maintaining good health.
815 - 2. They may enter through the respiratory tract, gastrointestinal tract, skin, or an open wound.
815 - 3. Report the illness soon; keep yourself and your living area clean; keep your nose, mouth, and skin covered; protect your food and water; keep alert to signs of BW attack; take your preventive medicine.

816 - 1. Kills about 99 percent of organisms pathogenic to man.
816 - 2. 15 minutes.
816 - 3. Several hours.
816 - 4. Fluid disinfectants, gaseous disinfectants, and disinfection by filtration.
816 - 5. Washing with soap and water.
816 - 6. If possible, disinfect with formaldehyde gas or wash with water with the addition of a fluid disinfectant.

817 - 1. Boiling.
817 - 2. When pronounced safe by the designated medical officer.
817 - 3. Probably safe if care is used in decontaminating the exterior surface and opening the container so as not to transfer contaminants to the food inside the container.
817 - 4. Meat items are ideal for bacterial growth because of their high moisture and protein content and their neutral pH condition.
817 - 5. By distillation if equipment is available or by iodine tablets (2 per canteen of water with 30 minutes contact time).
817 - 6. Swab tests performed by trained technical personnel.

CHAPTER 5

818 - 1. Inhibit the cytochrome oxidase enzyme system, thereby stopping tissue respiration.
818 - 2. Hot weather.
818 - 3. Mustards, arsenicals, and phosgene oxime.
818 - 4. It produces an immediate sensation of pain; about 30 minutes after exposure, the skin appears blanched with reddened "rings" followed a few hours later by a blister.
818 - 5. A pinpoint contraction of the pupils, causing a dimming of vision.
818 - 6. Difficulty in focusing eyes, headaches, general weakness, profuse sweating, tearing, and salivation. Later nausea, vomiting, and loss of bladder and bowel control will occur, and finally, if untreated, violent convulsions, coma, and death may be the result.
818 - 7. Cause temporary disabilities such as paralysis, blindness, deafness, and mental aberrations (e.g., confusion and hallucinations).

818 - 8. Fullness in nose and sinuses; pain in nose and thoat; severe headaches; and pain and tightness in chest. Additionally, eye irritation, tearing, sneezing, and coughing may be effects of these agents as well as vomiting and nausea.

819 - 1. You may be needlessly exposing yourself to potentially lethal levels of agents.
819 - 2. (1) M18A2 Kit—detects vapors, aerosols, and liquid droplets of chemical agents. Test results based on a color change. Kit can be used to identify specific chemical agent.
(2) M256 Kit—detects presence of chemical agents in air and liquid form. Can detect and classify nerve, blood, and blister agents in a short period of time; test results are colormetric, and this kit has a very limited agent specific identification.
(3) AN-M2 Water Test Kit—detects chemical agents in water; however, cannot detect low levels of nerve agents unless used in conjunction with the M18A2 Kit. A positive test indicates water can't be used unless it is purified; a negative test means water may be used for 3 days after disinfection.
819 - 3. Detects nerve agents only; can be used inside command posts, alert quarters, etc; will alarm on pesticides, solvents, colored smoke, and jet engine or diesel exhaust.
819 - 4. Eyes.

820 - 1. Learn to recognize clues, try to get upwind, use your protective mask and clothing.
820 - 2. Stop breathing.
820 - 3. Quickly detect the presence of agents; use protective equipment; give yourself quick and correct self-aid; avoid areas where chemical agents exist; decontaminate your equipment and yourself as soon as possible.
820 - 4. Upwind or to higher ground.

821 - 1. Don mask and clear it; remove agent from the skin with the M258 Kit; if the effect of nerve agents becomes apparent, use the antidote.
821 - 2. Remove individual from the area; remove clothing and scrub skin; wash eyes and gargle with a two percent baking soda solution; seek medical attention if individual does not respond immediately.
821 - 3. IM injections of atropine sulfate and 2-PAM chloride.
821 - 4. Vigorous activity.

822 - 1. Aerate for 24 hours or soak for 2 hours in 2 percent sodium bicarbonate or 5 percent chlorine. Peel or pare as desired.
822 - 2. Can't be decontaminated; it should be destroyed.
822 - 3. (1) Segregate suspected items.
(2) Inspect items for contamination.
(3) Decontaminate as possible.
(4) Reinspect items.
(5) Dispose of "grossly" contaminated items.
(6) Reissue items shown to be safe following reinspection.
822 - 4. Trim away all surface fat and badly contaminated areas. Wash or soak meat in a 2 percent sodium bicarbonate solution for 30 minutes.
822 - 5. The chemical, the nature of the contamination (vapor/liquid), the nature of the food, and a practical method of decontamination.

1985-631-028/20621 AUGAFS,AL(860648)800

STOP- 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

90850 05 23

MEDICAL READINESS

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (800) Medical readiness can *best* be defined as being

   a. ready to evacuate the site of a disaster.
   b. alert to situations which may cause a disaster.
   c. trained to expect the non-expected.
   d. ready to perform our medical mission under any circumstances.

2. (800) Communication is *most* important during which stage of a disaster?

   a. Recovery.
   b. Remedy.
   c. Warning.
   d. Rescue.

3. (801) Initially, what is the *most important* consideration in any disaster situation?

   a. Patient care.
   b. Transportation.
   c. Inspection of food supplies.
   d. Field sanitation.

4. (801) In a disaster situation, the continuing process of classifying and reclassifying the sick and injured according to the urgency and types of conditions presented is referred to as

   a. decontaminating expectants.
   b. sorting patients.
   c. classifying expectants.
   d. triaging patients.

5. (802) Which of the following are types of cyclonic storms?

   a. Tornadoes.
   b. Hurricanes.
   c. Hail storms.
   d. Thunderstorms.

6. (802) Which condition of medical readiness indicates destructive winds are imminent and that you should take appropriate precautions to minimize damage?

   a. I.
   b. II.
   c. III.
   d. IV.

7. (803) Which of the following natural disaster frequently catch people unprepared for last minute preparations?

   a. Volcanic eruptions.
   b. Heat waves.
   c. Tidal waves.
   d. Flash floods.

8. (803) What is the *first* hazard that needs to be considered in any disaster?

   a. Presence of disease vectors.
   b. Sources of food supplies.
   c. Potential for fire hazards.
   d. Contamination of food and water.

9. (804) Some principal causes of the detonation of explosive materials are

   a. carelessness, high temperature, and sudden shock.
   b. high temperature, improper storage, and mechanical failures.
   c. high temperature, mechanical failures, and sudden shock.
   d. sudden shock, mechanical failures, and carelessness.

10. (804) What are the three main effects usually produced by an explosion?

a. Airblast, shock wave, and fire.
b. Airblast, flying missiles, and fire.
c. Airblast, shock wave, and flying missiles.
d. Fire, earth shocks, and airblast.

11. (805) Select the term applied to an unexpected peacetime or noncombat nuclear weapon accident.

a. Bent Spear.
b. Dull Sword.
c. Faded Giant.
d. Broken Arrow.

12. (805) What is the *greatest* hazard associated with a nuclear weapon accident?

a. High-explosive detonation.
b. Radiation.
c. Tritium gas.
d. Fire.

13. (805) Which pair of the following elements may create a nonradiation hazard in the vicinity of a nuclear weapon accident?

a. Iodine and lead.
b. Lithium and iodine.
c. Lead and beryllium.
d. Beryllium and tritium.

14. (806) If radioactive contaminants have infiltrated the pores on the hand and cannot be removed, how can the individual be decontaminated?

a. By wearing rubber surgical gloves for 30 minutes.
b. By wearing rubber surgical gloves for 15 minutes.
c. By scrubbing with an alkaline soap and water for 5 minutes.
d. By vacuuming all exposed skin areas, and then using an organic solvent to clean the skin.

15. (806) The choice of which decontamination method to use when decontaminating equipment depends on

a. the effectiveness of the decontaminating agent.
b. the availability of the decontaminating agent.
c. the value of the equipment.
d. all of the above.

16. (806) Refer to Table 2-2. A piece of electronic radiation monitoring equipment has become contaminated with radioactive dust. The instrument is housed in a dry porous case. Which of the following is *best* for decontaminating the instrument?

a. Water.
b. Vacuum cleaning.
c. Organic solvents.
d. An acid mixture.

17. (807) Following a natural disaster, what types of food are considered safe if external surfaces are cleaned and checked before opening?

a. Tin cans and crimped-cap containers.
b. Sealed wax containers and screw-top cans.
c. Tin cans and sealed wax cartons.
d. Screw-top cans and tin cans.

18. (807) When foods are destroyed, who must assure that the items are either burned or buried?

a. Senior Environmental Health Service person.
b. Director of Base Medical Services.
c. Bioenvironmental Engineering personnel.
d. Property Disposal Officer.

19. (808) Which type of burst from a nuclear weapon detonation produces the greatest radiological hazard on the ground?

a. Subsurface.
b. Air.
c. Surface.
d. All produce the same amount.

20. (808) Which type of burst produces little or no radiation hazard on the ground?

a. Surface.
b. Air.
c. Subsurface.
d. Ground zero.

21. (809) After a nuclear warfare attack, what is the most rapid means of estimating the extent of radiological hazards?

a. Calculating wind speed and terrain characteristics.
b. Dispatching a truck convoy decon team to the site.
c. Performing an aerial survey utilizing helicopters.
d. Performing a ground survey of the area with high efficiency RADIAC equipment.

22. (809) The roentgen is a measure of ionization in air due to which of the following types of radiation?

a. Alpha and beta.
b. Gamma and X-ray.
c. Beta and gamma.
d. X-ray and alpha.

23. (809) The PAC-1S is calibrated to present a meter reading of the

a. counts per minute of alpha radiation.
b. counts per minute of gamma radiation.
c. miliroentgens per hour of alpha radiation.
d. miliroentgens per hour of beta radiation.

24. (810) Permeable protective clothing will *not* protect personnel against which form of chemical agents?

a. Gases.
b. Vapors.
c. Liquids.
d. Fine sprays

25. (810) How long can a person wearing an impermeable suit perform normal activities before becoming overheated and possibly collapsing if the environmental temperature is over 80° F?

a. 15 minutes.
b. 30 minutes.
c. 45 minutes.
d. 60 minutes.

26. (811) Which of the following reflects the correct steps to take when speed in decontaminating equipment is important?

a. Washing, brushing, aging.
b. Brushing, washing, aging.
c. Monitoring, washing, brushing.
d. Aging, brushing, washing.

27. (812) How should you treat meat affected by blast damage from a nuclear explosion?

a. Destroy it.
b. Monitor for radiation and trim affected areas.
c. Trim affected areas and cook it.
d. Monitor for radiation, then wash it.

28. (812) You can prevent the movement of iodine-131 through the food chain by using

a. aged cattle feeds.
b. stored milk.
c. thyroid blocking agents.
d. all of the above.

29. (812) Following a nuclear attack, how can potatoes and other hardskinned vegetables and fruits be decontaminated?

a. Soaking in a chlorine solution.
b. Boiling.
c. Peeling or scraping.
d. Baking.

30. (812) All of the following are means of minimizing food waste following a nuclear attack *except*

a. setting food aside to allow for radioactive decay.
b. using canned and packaged foods first and throwing perishable foods away.
c. if an emergency situation demands, blending contaminated food with uncontaminated material to reduce radioactivity.
d. using food rationing.

31. (813) Which of the following is probably *not* a characteristic of the appearance of biological agents?

a. Powder.
b. Aerosol.
c. Spots of a substance resembling motor oil.
d. Liquid or liquid droplets.

32. (814) Which of the following is generally *not* a characteristic of a biological agent?

a. It is rapid in action from time of exposure to symptoms.
b. The agent's presence cannot be detected by our senses.
c. Identification of the organism is often difficult.
d. Agents have a delayed action because of an incubation period.

33. (814) Which of the following statements concerning detection and identification of biological warfare agents is false?

a. You cannot see, feel, or taste germs spread in a BW attack.
b. Detection and identification may take several days.
c. Diagnosis may be made by placing the contaminated material under a microscope.
d. Detection and identification must be accomplished by trained personnel.

34. (815) Which of the following *best* prepares you in case of a biological attack?

a. Keeping in top physical condition.
b. Wearing your protective mask.
c. Becoming proficient in first aid against BW agents.
d. Ensuring that all immunizations are up to date.

35. (815) If in doubt about whether food is contaminated or not following a biological attack, boil it for at least

a. 5 minutes.
c. 20 minutes.
b. 10 minutes.
d. 30 minutes.

36. (816) Food contaminated with bacterial spores and certain toxins can be disinfected by which of the following methods?

a. Dipping in a 1 ppm hypochlorite solution.
b. Dipping in boiling water for 2-3 minutes.
c. Washing with an alkaline soap solution.
d. Boiling (100° Celsius) for several hours.

37. (816) What is the single most protective personal hygiene measure for the control of communicable diseases resulting from a biological attack?

a. Covering the mouth when sneezing.
b. Wearing surgical masks.
c. Washing with soap and water.
d. Preventing direct contact with other persons.

38. (817) In most situations, the most practical means of decontaminating food and water following a biological attack is through the use of

a. heat.
c. gaseous disinfectants.
b. filtration.
d. liquid disinfectants.

39. (817) Sealed containers of food should be decontaminated by immersion in what type of solution and for a minimum of how long?

a. 0.5 percent hypochlorite solution; 2 minutes.
b. 0.5 percent hypochlorite solution; 5 minutes.
c. 2 percent hypochlorite solution; 5 minutes.
d. 1 percent hypochlorite solution; 5 minutes.

40. (818) What chemical agent is *most* effective in hot weather, but may not produce symptoms for hours or even days following the exposure?

a. Blood agents.
c. Chocking agents.
b. Nerve agents.
d. Blister agents.

41. (818) Dimming of vision is probably the first effect you would notice if exposed to which of the following chemical agents?

a. Blood agents.
c. Blister agents.
b. Nerve agents.
d. Vomiting agents.

42. (819) The A/E 23D-3 chemical agent alarm is an automatic point detector for

a. nerve agents vapors only.
b. blood and blister agents only.
c. incapacitating agents only.
d. all chemical agents.

43. (819) How are unmasking procedures used to determine the presence of chemical agent when no chemical agent detector kit is available?

a. Everyone takes a deep breath; holds it; break the seal of their masks; exhales; waits for 5 minutes.
b. Two or three people break the seal on their masks; take a deep breath; hold it; remask and wait 10 minutes.
c. Everyone takes a deep breath; holds it; break the seal of their masks; exhales; waits for 10 minutes.
d. Two or three people take a deep breath; hold it; break the seal on their mask; and keep their eyes open for 15 seconds; clear masks; reestablish seal and wait 10 minutes.

44. (820) What must be done to any part of impregnated protective clothing that comes in contact with liquid blister agents?

a. Decontaminate with soap and water.
b. Rip off immediately.
c. Apply a protective dressing to neutralize the agent.
d. Rinse with water.

45. (820) During a chemical attack, you should do all of the following *except*

a. move upwind.
b. seek higher ground.
c. go to an underground shelter.
d. don protective clothing.

46. (821) If you were splashed in the eyes and on the face with an unknown liquid chemical warfare (CW) agent, your first self-aid action should be to

a. apply protective ointment.
b. administer an atropine injection.
c. decontaminate your eyes and face by flushing and washing with water.
d. don your protective mask and clear it.

47. (821) What solution is recommended for patient decontamination when washing eyes and gargles?

a. A 1 percent chlorine solution.
b. Soap and water.
c. Amyl nitrate solution.
d. A 2 percent baking soda solution.

48. (822) Which types of foods will normally *not* absorb significant amounts of mustard vapor?

a. Foods with a high moisture content.
b. Foods with a low moisture content.
c. Foods with a high fat content.
d. Foods with a high protein content.

49. (822) Mustards, arsenicals, and nerve agents are readily soluble in

a. water.
b. fat.
c. acid solutions.
d. alkaline solutions.

50. (822) In last resort decontamination of food, how should flour which has been stored in sacks be decontaminated from radioactive contamination?

a. Place in freezer for 24 hours.
b. Mix with water and boil for 20 min.
c. Place in air for several days.
d. It should not be decontaminated, but should be condemned and buried.

END OF EXERCISE

MAIL TO: ECI, GUNTER AFS AL 36118-5643

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012. PRINCIPAL PURPOSE: To provide student assistance as requested by individual students. ROUTINE USES: This form is shipped with ECI course package, and used by the student, as needed, to place an inquiry with ECI. DISCLOSURE: Voluntary. The information requested on this form is needed for expeditious handling of the student's inquiry. Failure to provide all information would result in slower action or inability to provide assistance to the student.

I

CORRECTED OR LATEST ENROLLMENT DATA

1. THIS REQUEST CONCERNS COURSE (1-5)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER
5. SOCIAL SECURITY NUMBER (7-15) – –	6. GRADE/RANK	7. NAME (First initial, second initial, last name) (17) – (18) – (19-32)	
8. ADDRESS OJT ENROLLEES: Address of unit training office with zip code. ALL OTHERS: Current mailing address with zip code.	(33-53) (54-75)		
9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE		10. TEST CONTROL OFFICE ZIP CODE/SHRED (11-16)	

II

REQUEST FOR MATERIALS, RECORDS, OR SERVICE

Place an "X" through number in box to left of service requested.

X		FOR ECI USE ONLY
1	Request address change as indicated in Section I, Block 8.	
2	Request Test Control Office change as indicated in Section I, Block 10.	
3	Request name change/correction. (Provide Old or Incorrect data here)	
4	Request Grade/Rank change/correction.	
5	Correct SSAN. (List incorrect SSAN here.) (Correct SSAN should be shown in Section I.)	
6	Extend course completion date. (Justify in "Remarks")	
7	Request enrollment cancellation. (Justify in "Remarks")	G [illegible]
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 10 Originals were: [ ] Not received [ ] Lost [ ] Misused	K VOL [illegible] GR [illegible]
9	Send course materials. (Specify in "Remarks") [ ] Not received [ ] Lost [ ] Damaged	M [illegible]
10	Course exam not yet received. Final VRE submitted for grading on ________ (date).	N [illegible]
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 10 not yet received. Answer sheet(s) submitted ________ (date).	VOL [illegible]
12	Results for CE not yet received. Answer sheet submitted to ECI on ________ (date).	P [illegible]
13	Previous inquiry ([ ] ECI Fm 17, [ ] ltr, [ ] msg) sent to ECI on ________ (date).	[illegible]
14	Give instructional assistance as requested on reverse.	Q 00 1
15	Other (Explain fully in "Remarks")	[illegible]

REMARKS (Continue on reverse)

OJT STUDENTS must have their OJT Administrator certify this request. ALL OTHER STUDENTS may certify their own requests.	I certify that the information on this form is accurate and that this request cannot be answered at this station. SIGNATURE

ECI FORM DEC 84 17 PREVIOUS EDITION WILL BE USED

BEST COPY AVAILABLE

SECTION III: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

VRE Item Questioned:

Course No _____ _____

Volume No __________

VRE Form No _________

VRE Item No _________

Answer You Chose _______ (Letter)

Has VRE Answer Sheet been submitted for grading?

☐ Yes ☐ No

REFERENCE

(Textual reference for the answer I chose can be found as shown below)

In Volume No __________

On Page No __________

In ☐ left ☐ right column

Lines ____ Through _____

MY QUESTION IS:

REMARKS

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. Course workbooks have a Form 17 printed on the last page.